TUCSON
AIRPORT AUTHORITY

Appendix C

F.A.R. PART 150 REVIEW

Appendix C-1
INVENTORY

As revision of the F.A.R. Part 150 Noise Compatibility Plan (NCP), requires an evaluation of changes in the airport environment since the previous Ryan Airfield (RYN) NCP was approved August 4, 1992.

This review begins with an inventory which includes an examination of the existing airport facilities, area airspace, and air traffic control, as well as an update of the airport's development history. In addition background information regarding the Tucson area is updated. This includes descriptions of the airport's setting in regional and national aviation systems, the regional climatology, surface transportation, as well as a review of other area planning and development efforts that might affect the noise compatibility efforts. This section also addresses the status of individual recommendations presented in the previous NCP.

The information in this chapter attempts to provide a foundation, or starting point, for the subsequent chapters. It is essential to the success of the F.A.R Part 150 Review that the inventory be complete and accurate, since the findings and assumptions made in this document are dependent upon the information collected concerning the airport and the area it serves.

The information outlined in this chapter was obtained through on-site inspections, interviews with airport staff, airport tenants, and representatives of Pima County Planning, the Arizona Department of Transportation (ADOT), and the Federal Aviation Administration (FAA). Information was also obtained from available documents concerning the airport and the Tucson area, including the previous **Noise Compatibility Plan** (1990).

A review of the F.A.R. Part 150 Study is being prepared at the same time as the Airport Master Plan Update for Ryan Airfield. This provides ample opportunity for the full assessment of potential noise impacts of alternative master planning strategies. At the same time, it enables a thorough analysis of potential airport modifications that could promote noise abatement.

JURISDICTIONS AND RESPONSIBILITIES

Reduction of aircraft noise impacts is a complex issue, with several parties sharing in the responsibility: the federal government, state and local governments and planning agencies, the airport proprietor, military and civilian airport users, shippers of cargo, and local residents. All interests must be considered in the noise compatibility planning process.

FEDERAL

Aviation plays a vital role in interstate commerce. Recognizing this, the federal government has assumed the role of coordinator and regulator of the nation's aviation system. Congress has assigned administrative authority to the Federal Aviation Administration (FAA). Specific responsibilities of the FAA include:

- The regulation of air commerce in order to promote its development and safety and to fulfill the requirements of national defense;
- The promotion, encouragement and development of civil aeronautics;
- The control of the use of navigable airspace and the regulation of civil and military aircraft operations to promote the safety and efficiency of both;
- The development and operation of a common system of air traffic control and navigation for both military and civil aircraft.

Congress has passed legislation and the FAA has established regulations governing the preparation of noise compatibility programs. They have also created laws and regulations requiring the conversion of the commercial aircraft fleet to quieter aircraft.

F.A.R. Part 150 Noise Compatibility Studies

The *Aviation Safety and Noise Abatement Act of 1979* (ASNA, P.L. 96-193), signed into law on February 18, 1980, was enacted, ". . . to provide and carry out noise compatibility programs, to provide assistance to assure continued safety in aviation, and for other purposes." The FAA was vested with the authority to implement and administer the Act.

Federal Aviation Regulation (F.A.R.) Part 150, the administrative rule promulgated to implement the Act, sets requirements for airport operators who choose to undertake an airport noise compatibility study with federal funding assistance. Part 150 provides

for the development of two final documents: noise exposure maps and a noise compatibility program.

Noise Exposure Maps. The noise exposure maps document (NEM) shows existing and future noise conditions at the airport. It can be thought of as a baseline analysis defining the scope of the noise situation at the airport. It includes maps of noise exposure for the current year and a five-year forecast. The noise contours are shown on a land use map to reveal areas of noncompatible land use. The document includes detailed supporting information explaining the methods used to develop the maps.

Part 150 requires the use of standard methodologies and metrics for analyzing and describing noise. It also establishes guidelines for the identification of land uses which are incompatible with noise of different levels. Airport proprietors are required to update noise exposure maps when changes in the operation of the airport would create any new, substantial noncompatible use. This is defined as an increase in noise levels of 1.5 DNL (Yearly Day-Night Average Sound Level) over noncompatible land uses.

A limited degree of legal protection can be afforded to the airport proprietor through preparation and submission of noise exposure maps. Section 107(a) of the ASNA Act provides that:

> *No person who acquires property or an interest therein . . . in an area surrounding an airport with respect to which a noise exposure map has been submitted . . . shall be entitled to recover damages with respect to the noise attributable to such airport if such person had actual or constructive knowledge of the existence of such noise exposure map unless . . . such person can show --*
>
> *(i) A significant change in the type or frequency of aircraft operations at the airport; or*
>
> *(ii) A significant change in the airport layout; or*
>
> *(iii) A significant change in the flight patterns; or*
>
> *(iv) A significant increase in night-time operations occurred after the date of acquisition of such property . . .*

The ASNA Act provides that "constructive knowledge" shall be attributed to any person if a copy of the noise exposure map was provided to him at the time of property acquisition, or if notice of the existence of the noise exposure map was published three times in a newspaper of general circulation in the area. In addition, Part 150 defines "significant increase" as an increase of 1.5 DNL. For purposes of this provision, FAA officials consider the term "area surrounding an airport" to mean an area within the 65 DNL contour. (See F.A.R. Part 150, Section 150.21 (d), (f) and (g).)

Acceptance of the noise exposure maps by the FAA is required before it will approve a noise compatibility program for the airport. (The previous noise

exposure maps were found to be in compliance and accepted on April 5, 1990.)

Noise Compatibility Program. A noise compatibility program includes provisions for the abatement of aircraft noise through aircraft operating procedures, air traffic control procedures, airport regulations, or airport facility modifications. It also includes provisions for land use compatibility planning and may include actions to mitigate the impact of noise on noncompatible land uses. The program must contain provisions for updating and periodic revision.

F.A.R. Part 150 establishes procedures and criteria for FAA evaluation of noise compatibility programs. Among these, two criteria are of particular importance: the airport proprietor may take no action that imposes an undue burden on interstate or foreign commerce, nor may the proprietor unjustly discriminate between different categories of airport users.

With an approved noise compatibility program, an airport proprietor becomes eligible for funding through the Federal Airport Improvement Program to implement the eligible items of the program.

The FAA recently enacted a new policy for Part 150 approval and funding of noise mitigation measures. This policy increases the incentives for airport operators to discourage the development of new noncompatible land uses around airports and to assure the most cost-effective use of Federal funds spent on noise mitigation measures.

Under the new policy, the FAA will not approve measures in Noise Compatibility Programs proposing corrective noise mitigation actions for new noncompatible development that is allowed to occur in the vicinity of airports after October 1, 1998, the effective date of this policy. As of the same effective date, AIP funding under the noise set-aside will be determined using criteria consistent with this policy. Specifically, corrective noise mitigation measures for new noncompatible development that occurs after October 1, 1998 will not be eligible for AIP funding under the noise set-aside, regardless of previous FAA approvals under Part 150. The new policy does not affect funding under the Airport Improvement Program for noise mitigation projects that do not require Part 150 approval, that can be funded with Passenger Facility Charges (PFC) revenue, or that are included in FAA-approved environmental documents for airport development.

F.A.R. Parts 36 And 91 Federal Aircraft Noise Regulations

The FAA has required reduction of aircraft noise at the source through certification, modification of engines, or replacement of aircraft. F.A.R. Part 36 prohibits the further escalation of noise levels of subsonic civil turbojet and transport category aircraft. It also requires new airplane types to be markedly quieter than earlier models. Subsequent amendments have extended the noise standards to include small, propeller-driven airplanes and supersonic transport aircraft.

F.A.R. Part 36 has three stages of certification. Stage 3 is the most rigorous and applies to aircraft certificated since November 5, 1975. Stage 2 applies to aircraft certificated between December 1, 1969 and November 5, 1975. Stage 1 includes all previously certificated aircraft.

F.A.R. Part 91, Subpart I, known as the "Fleet Noise Rule," mandated a compliance schedule under which Stage 1 aircraft were to be retired or refitted with hush kits or quieter engines by January 1, 1988. A very limited number of exemptions have been granted by the U.S. Department of Transportation for foreign aircraft operating into specified international airports.

Pursuant to the Congressional mandate in the *Airport Noise and Capacity Act of 1990*, the FAA has established amendments to F.A.R. Part 91 by setting December 31, 1999 as the date for discontinued use of all Stage 2 aircraft exceeding 75,000 pounds. The FAA may grant an airline an extension of the deadline to December 31, 2003 if, by July 1, 1999, their fleets include no more than 15 percent Stage 2 aircraft. The Part 91 amendments also provide for two alternative phase-out schedules through the 1990s. The first is described in terms of the phase-out of Stage 2 aircraft; the second in terms of the phase-in of Stage 3 aircraft.

Under the first alternative, an airline must have eliminated or retrofitted 25 percent of its Stage 2 fleet by the end of 1994, 50 percent by the end of 1996, and 75 percent by the end of 1998. Under the second alternative, an airline must have a fleet of no less than 55 percent Stage 3 aircraft by the end of 1994, 65 percent by the end of 1996, and 75 percent by the end of 1998.

Neither F.A.R. Part 36 nor Part 91 apply to military aircraft. Nevertheless, many of the advances in quiet engine technology are being used by the military as they upgrade aircraft to improve performance and fuel efficiency.

F.A.R. Part 161
Regulation of Airport Noise And Access Restrictions

F.A.R. Part 161 sets forth requirements for notice and approval of local restrictions on aircraft noise levels and airport access. Part 161 was developed to implement the *Airport Noise and Capacity Act of 1990*. It applies to local airport restrictions that would limit operations by Stage 2 or 3 aircraft. These include direct limits on maximum noise levels, nighttime curfews, and special fees intended to encourage changes in airport operations to lessen noise.

In order to implement noise or access restrictions on Stage 2 aircraft, the airport operator must provide public notice of the proposal and provide at least a 45-day comment period. This includes notification of FAA and publication of the proposed restriction in the *Federal Register*. An analysis must be prepared describing the proposal, alternatives to the proposal, and the costs and benefits of each.

Noise or access restrictions on Stage 3 aircraft can be implemented only after receiving FAA approval. Before granting approval, the FAA must find that six conditions specified in the statute, and listed below, are met.

(1) The restriction is reasonable, non-arbitrary and nondiscriminatory.

(2) The restriction does not create an undue burden on interstate or foreign commerce.

(3) The proposed restriction maintains safe and efficient use of the navigable airspace.

(4) The proposed restriction does not conflict with any existing federal statute or regulation.

(5) The applicant has provided adequate opportunity for public comment on the proposed restriction.

(6) The proposed restriction does not create an undue burden on the national aviation system.

In its application for FAA review and approval of the restriction, the airport operator must include an environmental assessment of the proposal and a complete analysis addressing the six conditions. Within 30 days of the receipt of the application, the FAA must determine whether the application is complete. After a complete application has been filed, the FAA publishes a notice of the proposal in the Federal Register. It must approve or disapprove the restriction within 180 days of receipt of the completed application.

Airport operators that implement noise and access restrictions in violation of F.A.R. Part 161 are subject to termination of eligibility for airport grant funds and authority to impose and collect passenger facility charges.

Air Traffic Control

The FAA is responsible for the control of navigable airspace and the operation of air traffic control systems at the nation's airports. Airport proprietors have no direct control over airspace management and air traffic control, although they can propose changes in procedures.

The FAA reviews any proposed changes in flight procedures, such as flight tracks or runway use programs, proposed for noise abatement on the basis of safety of flight operations, safe and efficient use of the navigable airspace, management and control of the national airspace and traffic control systems, affect on security and national defense, and compliance with applicable laws and regulations. Typically, FAA implements and regulates flight procedures pertaining to noise abatement through the local air traffic control manager.

STATE AND LOCAL

Control of land use in noise-impacted areas around airports is a key tool in limiting the number of citizens exposed

to noise. The FAA encourages land use compatibility in the vicinity of airports, and F.A.R. Part 150 has guidelines relating to land use compatibility based on varying levels of noise exposure. Nevertheless, the federal government has no direct legal authority to regulate land use. That responsibility rests exclusively with state and local governments.

State

Although the State of Arizona does not directly implement and administer general purpose land use regulations, it has vested cities, towns, and counties with that power through enabling legislation. *Arizona Revised Statutes* do not mandate the establishment of planning commissions, agencies or departments in municipalities; however, where such appointments are made, the municipality is required to prepare and adopt a long-range general plan, and may regulate zoning, subdivision and land development, consistent with the plan.

The Arizona Department of Transportation (ADOT) is required by state law A.R.S. 28-1598 Section I to reassess the needs of the state's aviation needs every five years. ADOT adopted its first Arizona *State Aviation Needs Study* (SANS) in 1985 with subsequent updates in 1990 and 1995. The SANS serves as a guide for meeting the future air transportation needs of the region. The SANS provides state decision makers with a full assessment of the state's existing and future aviation needs, direction for meeting projected demand levels, and projected system costs for maintaining the State's aviation network. State officials can then budget state-allotted funds for projected system-wide expenditures.

Local Government

In the Ryan Airfield Study Area, Pima County is responsible for land use regulation.

In addition to regulating land use, local governments may acquire property to mitigate or prevent airport noise impacts or may sponsor sound insulation programs for this purpose. They are also eligible to apply for FAA grants under Part 150 if they are designated as a sponsor of a project in an approved noise compatibility program.

AIRPORT ADMINISTRATION

Although located in unincorporated Pima County, the Ryan Airfield is owned by the City of Tucson and is operated by the Tucson Airport Authority (TAA).

The Tucson Airport Authority is charged with the management and operation of Ryan Airfield, under an agreement with the City of Tucson.

AIRPORT SETTING

The National Plan of Integrated Airport Systems (NPIAS), has established by the Federal Aviation Administration (FAA), identifies the 3,660 airports that are important to national transportation. Ryan Airfield is

identified as a general aviation reliever airport. Reliever airports are designated to provide general aviation pilots with an attractive alternative to using congested hub airports. There are approximately 290 reliever airports in the nation. Ryan Airfield is one of eight reliever airports in Arizona and is joined by Avra Valley as the only two reliever airports for Tucson International Airport. ***Exhibit 1A*** *following page 1-2 in the Ryan Airfield Master Plan* depicts the airport in its regional and state setting.

LOCALE

Ryan Airfield situated at an elevation of 2,415 feet above mean sea level (MSL) and encompasses 1,555 acres in unincorporated Pima County, 10 miles southwest of Tucson. The airfield is located immediately north of the junction of Valencia Road and the Ajo Highway (State Route 86).

AIRPORT HISTORY

Since its commencement during World War II, Ryan Airfield has experienced a significant expansion of its general aviation facilities This has included the extension of the primary runway from 4,000 feet to 5,500 feet in 1982-1983 and the installation of a permanent air traffic control tower (ATCT) in 1993; the construction of a 4,900 foot-long parallel runway in 1993. The existing airfield and Terminal facilities are delineated in *Chapter 1 of the Ryan Airfield Master Plan on pages 1-6 to 1-14 and* ***Exhibit 1B.***

OTHER AREA AIRPORTS

There are five other airports in the vicinity that are open to the public, one military base (Davis-Monthan AFB), and approximately five private, restricted use airports. Theses airports are described in detail in *Chapter 1, pages 1-16 and 1-17, and depicted on* ***Exhibit 1E*** *of the Ryan Airfield Master Plan.*

AIRSPACE ENVIRONMENT

Airspace, navigational aids and flight procedures have a significant impact on a number of aircraft operating criteria such as altitude, communications, navigation, air traffic services, reduced visibility procedures, and pilot qualifications. These factors aid in defining the types of aircraft operations which can be expected in the region. Since aviation noise is directly related to aircraft operations in the vicinity of an airfield, an examination of a regions flight environment is helpful defining potential sources of aircraft noise.

AIRSPACE STRUCTURE

Since the inception of aviation, nations have set up procedures within their territorial boundaries to regulate the use of airspace. Airspace relates primarily to requirements for pilot qualifications, ground to air communications, navigation and air traffic services, and weather conditions. *Chapter 1, pages 1-14 to 1-15, and* ***Exhibits 1D and 1E*** *of the Ryan Airfield Master Plan* describe the categories of airspace and controlling facilities in the Tucson area.

ENROUTE NAVIGATIONAL AIDS

Navigational aids (NAVAIDS) provide direction, range, and/or position information to pilots. NAVAIDS are usually classified as either enroute or terminal NAVAIDS. The enroute NAVAIDS provide point to point navigation while terminal NAVAIDS provide approach and landing guidance.

Enroute NAVAIDS use various ground-based transmission facilities and on-board receiving instruments. Enroute NAVAIDS often provide navigation to more than one airport as well as to aircraft traversing the area. The types of enroute NAVAIDS that operate in the study area are listed below:

- VOR (Very High Frequency Omnidirectional Range). Provides aircraft course guidance.
- TACAN (Tactical Air Navigation). primarily a military-oriented facility, is often collocated with a VOR station. TACAN provides both course guidance and line-of-sight distance measurement.
- DME (Distance measuring equipment). DME emits signals enabling pilots of properly equipped aircraft to determine their line-of-sight distance from the facility (usually a VOR).
- NDB (Non-directional Beacon). Provides a limited range signal which can be used to "home in" on the facility.

For aircraft enroute or departing the Tucson area, there area several Victor airways available. Victor airways are corridors of airspace eight miles wide that extend upward from 3,000 feet above the ground and extend upward to 18,000 feet MSL. The airways run between VOR navigational aids. The Tucson VORTAC is the converging point for Victor airways in the Tucson area. The Tucson (TUS) VORTAC, located on Tucson International Airport, is the primary enroute navigational aid for the Tucson area.

There are six Victor Airways in the vicinity of the airport. V16, V105, V395, V528, V393, and V202 all originate from the Tucson VORTAC.

INSTRUMENT APPROACHES

Instrument approaches are defined using electronic and visual navigational aids to assist pilots in landing when visibility is reduced below specified minimums. While these are especially helpful during poor weather, they often are used by commercial pilots when visibility is good. Instrument approaches are classified as precision and nonprecision. Both provide runway alignment and course guidance, while precision approaches also provide glide slope information for the descent to the runway.

Precision Instrument Approaches

Most precision approaches in use in the United States today are instrument landing systems (ILS). An ILS provides

an approach path for exact alignment and descent of an aircraft on final approach to a runway. The system provides three functions: guidance, provided vertically by a glide slope (GS) antenna and horizontally by a localizer (LOC); range, furnished by marker beacons or distance measuring equipment (DME); and visual alignment, supplied by the approach light systems and runway edge lights.

Tucson Ryan Airfield has one published precision approach. Runway 6R is equipped with an ILS consisting of a localizer and glide slope antenna. This ILS system also has outer and middle marker beacons. The ILS approach is depicted on **Exhibit C-1A**.

Nonprecision Approaches

Nonprecision approaches are the most common type of available instrument approach available. Since a nonprecision approach does not utilize a glideslope, they do not require the additional instrumentation and facilities needed in a precision approach. A nonprecision approach does not utilize a glideslope therefore, only providing horizontal guidance. The purpose of this approach is to allow a pilot to descend to an area within close proximity to the airport during adverse visibility conditions, although not necessarily alining the aircraft for a landing at a particular runway. For these reasons the minimum decent altitudes and visibility requirements are more restrictive than that of a precision approach.

There are five nonprecision approaches currently available at Ryan Airfield. These approaches utilize either the Ryan NDB, ILS 6R localizer, DME, or GPS equipment. The nonprecision approaches available at Ryan Airfield are as follows:

- Runway 6R NDB/DME approach. This approach is flown with a combination of an NDB signal and DME fixes.

- NDB-D approach. This approach simply requires an aircraft to home in on a single NDB. (*Occasionally, a nonprecision approach is designated with a letter rather than a runway number. This is an indication that the approach is not alined within 30 degrees of the runway and/or the minimum decent altitude (MDA) is not low enough for the aircraft to complete a straight in landing.*)

- Runway 6R GPS approach. This approach utilizes a series of three satellite defined waypoints.

- The GPS-D approach. This approach utilizes satellite signals to define the airport location and requires an aircraft to circle to land at an appropriate runway once the approach is complete.

- 24R Localizer approach. Although not specifically listed as an approach, the localizer for the ILS 26R approach can be used as a means to complete a nonprecision approach.

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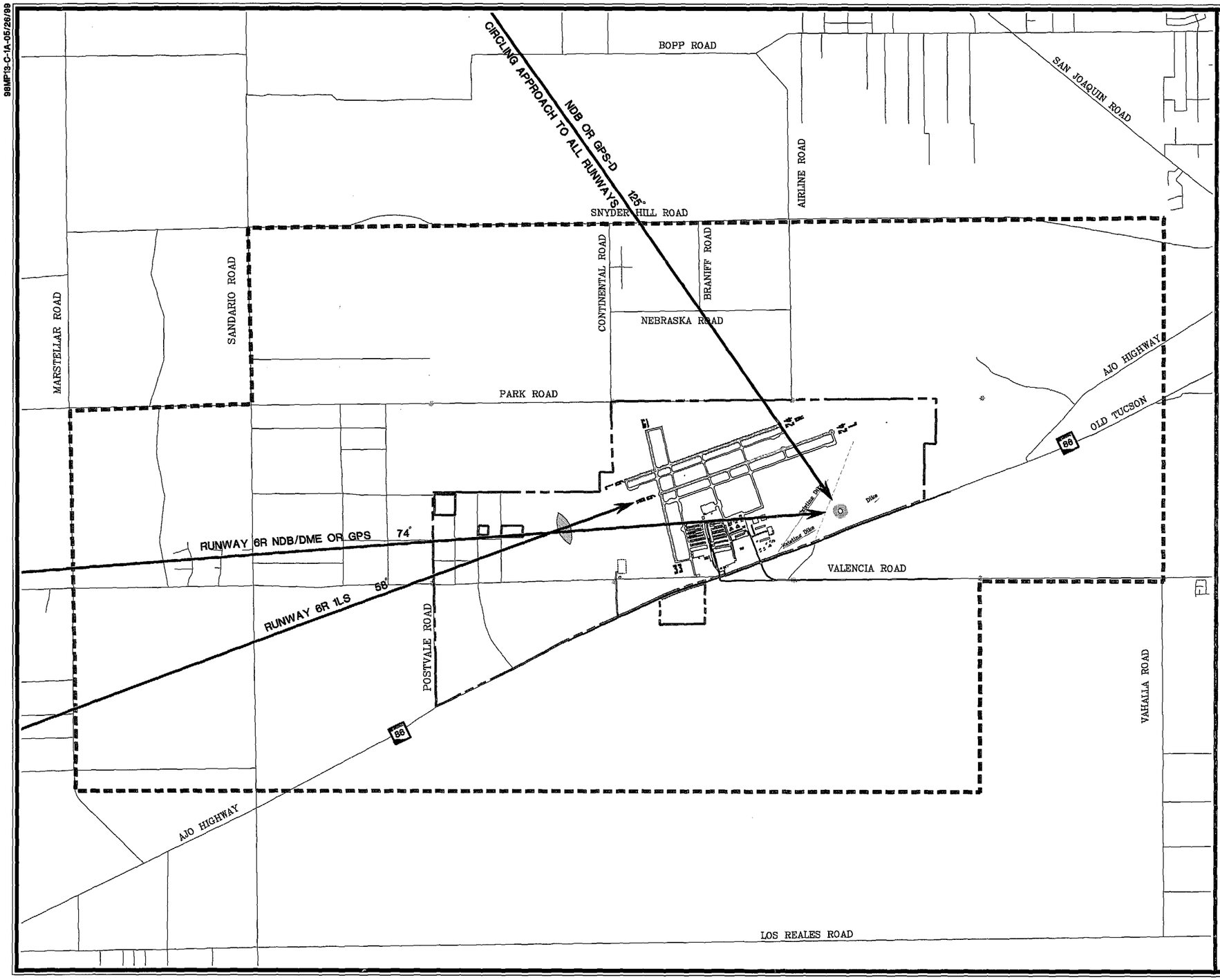

Exhibit C-1A
NAVIGATIONAL AIDS DEFINING INSTRUMENT APPROACHES

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Marker Beacon
- Non-directional Radio Beacon (NDB)
- ILS — Instrument Landing System
- GPS — Global Positioning System Approach
- DME — Distance Measuring Equipment

Source: Digital Map from Pima County, Land Information System for ArcView 3.0 October 1, 1998, Updated by Coffman Associates, March 1999

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CUSTOMARY ATC AND FLIGHT PROCEDURES

Flights to and from Tucson Airfield are conducted using both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR). Instrument Flight Rules are those that govern the procedures for conducting instrument flight. Visual Flight Rules govern the procedures for conducting flight under visual conditions (good weather). Under VFR conditions, the pilot is responsible for collision avoidance and will typically contact the tower when approximately 10 miles from the airport for sequencing into the traffic pattern. Most air carrier, military, and general aviation jet operations are conducted under IFR regardless of the weather conditions.

As a means of obstacle clearance for departing aircraft, primarily centering on aircraft departing at night or times of decreased visibility, a departure procedure has been published for Ryan Airfield. This procedure advises departing aircraft to fly direct to the Ryan NDB (RYN) and climb in a holding pattern to 5,000 feet MSL before proceeding on course. This procedure applies to aircraft departing all runways.

COMMUNITY PROFILE

A community profile provides a general look at the socioeconomic make-up of the community that utilizes an airport. It also provides an understanding of the dynamics for growth and the potential changes that may affect aviation demand, and in turn, aviation related noise. Aviation demand forecasts are normally directly related to the population base, economic strength of the region, and the ability of the region to sustain a strong economic base over an extended period of time. *Chapter 1, pages 1-17 to 1-21 of the Ryan Airfield Master Plan* describes the current demographic and economic information collected from several local, state and federal sources.

STUDY AREA

Exhibit C-1B shows the selected study area, encompassing approximately 15.6 square miles, all of which is in unincorporated Pima County. The study area is bounded by Sandario and Marstellar Roads on the west; Snyder Hill Road on the north, and defined by section lines on the east and south. This is the area where most of the detailed noise and land use analysis is expected to occur.

The study area is primarily for statistical convenience and can be modified in a later study if necessary. It should be emphasized that this area is for the presentation of detailed data – it is not a definition of the noise impact area. Areas adversely affected by noise will be defined in later analysis.

EXISTING LAND USE

Exhibit C-1B shows existing land use in the Ryan Field study area. The map was developed from aerial photography taken in January of 1999, a field survey made by the consultant in September 1998, and the aid of existing land use maps obtained from Pima County

Planning and Development. The land use categories shown on the map were selected to conveniently fit the requirements of noise and land use compatibility planning. **Table C-1A** lists the land use categories shown on the existing land use map.

The majority of the study area is undeveloped rangeland. This is especially evident in the area to the north of the airport. This region is composed of a small industrial development, one single family residence, and several mobile homes. The remaining is relatively vacant open space.

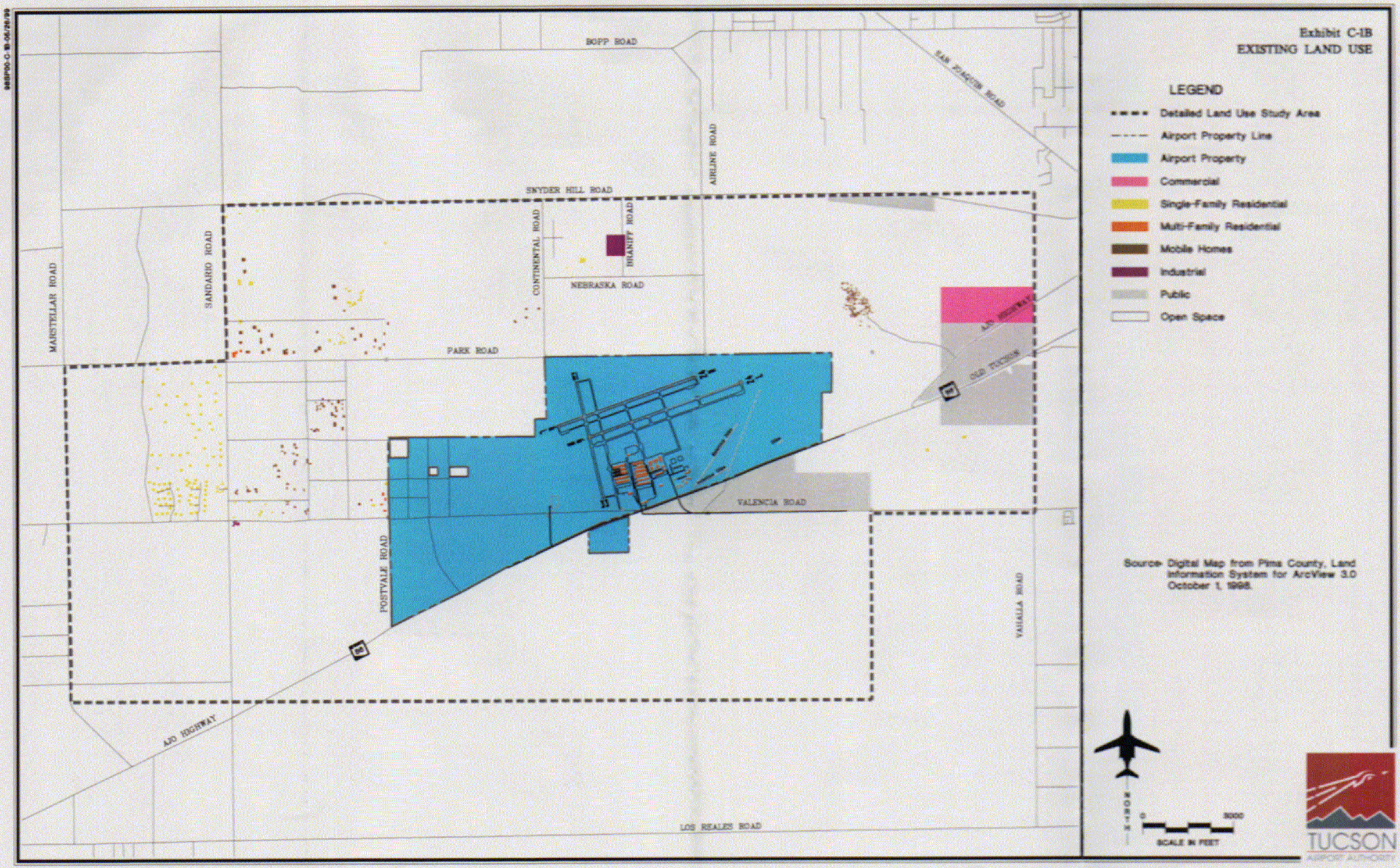
The area east of the airport also consist largely of vacant open space containing a small commercial development, a cluster of mobile homes and public property.

Open space in the form of undeveloped rangeland dominates the region of the study area to the south of Ryan Airfield. There is no noise-sensitive development south of Valencia.

TABLE C-1A
Land Use Categories Shown on Existing Land Use Map

Category	Land Uses Included
Single-Family Residential	Single-Family .3 to 5.4 dwellings/acre, Libraries, Agriculture, Livestock, Playgrounds
Multi-Family Residential	Single-Family, Multi-Family dwellings, Recreational Facilities
Mobile Home	Single-Family, Mobile Homes, Duplexes, Cemeteries, Livestock, Schools, Churches, Clinics, Child Care Centers, Libraries, Parks, Group Homes
Commercial	Cemeteries, Recreational Facilities, Schools, Offices, Retails, Enclosed Storage Libraries, Places of Worship, Motels
Industrial	Airports, Restaurants, Clinics, Hotels
Public	Airports, Misc. Government
Open Space	Vacant Lots, Open Parcels of Land

Although also primarily dominated by open space, the region to the west of Ryan Airfield contains the majority of the noise sensitive land uses within the


BOPP ROAD
SAN JOAQUIN ROAD
AIRLINE ROAD
SNYDER HILL ROAD
MARSTELLAR ROAD
SANDARIO ROAD
CONTINENTAL ROAD
BRANIFF ROAD
NEBRASKA ROAD
PARK ROAD
I-19
OLD TUCSON
VALENCIA ROAD
POSTVALE ROAD
VAHALLA ROAD
AJO HIGHWAY
LOS REALES ROAD
Exhibit C-1B
EXISTING LAND USE
LEGEND
Detailed Land Use Study Area
Airport Property Line
Airport Property
Commercial
Single-Family Residential
Multi-Family Residential
Mobile Homes
Industrial
Public
Open Space
Source: Digital Map from Pima County, Land Information System for ArcView 3.0 October 1, 1998.
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study area. Immediately to the east of airport property is a region of sporadically spaced mobile homes with intermittently situated multi/single-family residential uses. The area to the north of Park Road contains similar clusters of these three land uses. A relatively large cluster of single-family residential homes is located east of Sandario Road approximately one mile east of the airport property.

In addition to the surrounding study area, several noise sensitive land uses are contained within the airport property. These include multi-family, single-family residential, and mobile home land uses, the majority of which is located east and south of the airport facilities. The mobile home development is situated on islands of privately owned parcels surrounded by airport property.

SCHOOL DISTRICTS

There are 2 school districts within the Tucson Ryan Airfield Study Area: The Tucson Unified School District and the Altar School District. One new school is being proposed in the Tucson Unified School District, however, the location is well outside the study area. **Exhibit C-1C** depicts the school districts in the Ryan Airfield study area.

LAND USE PLANNING POLICIES AND REGULATIONS

In most cities and counties, the chief land use regulatory document is the zoning ordinance which regulates the types of uses, building height, bulk, and density permitted in various locations. Subdivision regulations are another important land use tool, regulating the platting of land. Local communities also regulate development through building codes. Non-regulatory policy documents which influence development include the general plan and the local capital improvements program. The general plan provides the basis for the zoning ordinance and sets forth guidelines for future development. The capital improvements program is typically a short-term schedule for constructing and improving public facilities, such as streets, sewers and water lines.

The following paragraphs describe each of the above areas as a means towards understanding the land use planning policies and regulations impacting the study area.

REGULATORY FRAMEWORK

In the Ryan Airfield Study Area, Pima County is responsible for land use regulation. The county administers zoning ordinances, subdivision regulations, and building codes.

Arizona state law requires counties to prepare a comprehensive, generalized land use plan for development of their area of jurisdiction. The county plan shall also provide for zoning and the delineation of zoning districts. The county is also responsible for regulating the subdivision of all lands within its corporate limits, except subdivisions which are regulated by municipalities. Adoption of building codes are optional for those counties which have adopted zoning. Pima County does regulate land use within the Study Area.

Within the Ryan Airfield Study Area, Pima County has prepared and adopted general plans, zoning ordinances, subdivision regulations and building codes. These planning and development tools are described below.

GENERAL PLANS

Comprehensive, long-range plans serve as a guide to individual communities and jurisdictions to provide quality growth and development. The plans represent a generalized guideline, as opposed to a precise blueprint, for locating future development. The plan generally consists of elements which examine existing land uses and designates proposed future land uses and facilities. By illustrating preferred land use patterns, including extraterritorial areas, a general plan can be used by community decision-makers and staff, developers, investors, and citizens to assist them in evaluating future development opportunities. **Exhibit C-1D,** depicts the proposed future land uses for the study area.

Chapter 18.89 of the Pima County Code sets forth requirements for the preparation and adoption of land use plans. It defines the county comprehensive plan as a plan covering all of the county, prepared in conjunction with the incorporated municipalities of the county. It also defines three more levels of planning documents covering progressively smaller geographic areas at increasing levels of detail. These are the "area", "community", and "neighborhood" plans.

The code also establishes procedures for the periodic review and updating of land use plans.

In 1992, Pima County adopted a Comprehensive Land Use Plan which was subsequently revised in 1996. The Plan divides Pima County into six subregions based on specific sub-regional characteristics. Each subregion is assigned key issues which create a foundation for planning within that subregion. Tucson Ryan Airfield is contained in the "Tucson Mountains Subregion" which is dominated by characteristics such as a high natural resource content, scenic value, and an expansive 100-year floodplain. Currently, much of this area is rural in character and contains mostly low density residential uses and large tracts of undeveloped land. The northeast portion of this subregion, however, borders the City of Tucson and is therefore becoming urbanized. The key comprehensive planning issues in the Tucson Mountains Subregion are:

- City of Tucson Sphere of Influence.

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BOPP ROAD

SAN JOAQUIN ROAD

VESEY

VALENCIA

AIRLINE ROAD

SNYDER HILL ROAD

MARSTELLAR ROAD

SANDARIO ROAD

CONTINENTAL ROAD

BRANIFF ROAD

NEBRASKA ROAD

AJO HIGHWAY

PARK ROAD

OLD TUCSON

86

Dike

Dike

VALENCIA ROAD

POSTVALE ROAD

86

VAHALLA ROAD

LAWRENCE

HOHOKAM

AJO HIGHWAY

LOS REALES ROAD

Exhibit C-1C
TUCSON UNIFIED SCHOOL DISTRICTS

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Elementary School District
- Middle School District
- High School District

Source: Digital Map from Pima County, Land Information System for ArcView 3.0 October 1, 1998.

NORTH

0 3000

SCALE IN FEET

TUCSON
AIRPORT AUTHORITY

- Resource Transition to Public Reserves such as Tucson Mountain Park and Saguaro National Monument.

- Open Space, Habitat, Wildlife Corridors.

- Scenic Resources.

- San Xavier District/Tohonto O'odham Nation.

- Central Arizona Project (CAP).

The Pima County Comprehensive Land Use Plan designates "Special Areas" as a means to accomplish site specific planning objectives. The 2-01 Ajo Corridor/Western Gateway Special Area has been established to encourage "appropriate" development in the vicinity of Ryan Airfield. This development is designed to "promote planned nodal development along the Ajo Corridor; preserve scenic quality, and mitigate the negative impacts of large planned industrial areas". The specific policies contained in this Special Area are as follows:

- The gateway area in the vicinity of Ryan Airfield shall accommodate support business for the airport and shall have design standards which will incorporate an airport/aviation/ industrial theme.

- Site planning and design of industrial and support businesses within this special area shall be designed to promote internal circulation and minimize curb cuts and/or strip commercial development.

- Landscaping shall promote preservation of natural vegetation and application of xeriscape concepts in landscape design.

- Areas to remain natural in this gateway corridor area shall be supplementally planted with plant materials natural to this area and broadcast with desert wildflower seed mix for an area of 40 feet on both sides of the right-of-way.

- The area of Black Wash within this special area shall be preserved and restored as riparian habitat. All development affecting Black Wash, including public works, shall be required to preserve and restore riparian habitat, and provide opportunities for view enhancement and interpretive signage. A scenic pull-off to include interpretation of the riparian area and a view orientation to the visible mountain ranges shall be encouraged.

The Ajo Corridor/Western Gateway Special Area is shown on **Exhibit C-1D.**

ZONING

While general land use plans are general land use policy guidelines, cities and counties actually control land use

through zoning ordinances. In the study area, Pima County has established a zoning ordinance.

This section summarizes the Pima County zoning ordinance. This information will be used in subsequent chapters to identify zoning districts which provide a compatible land use buffer and those that allow encroachment by noise-sensitive land uses. For zoning districts which permit noise-sensitive land uses, this information will provide insights into how the district regulations may be amended to promote noise-compatible development.

The Pima County Zoning Code is administered by the Planning and Development Services Department. The regulations require that building permits, zoning use permits, and zoning construction permits cannot be issued until compliance with the Zoning Code has been established.

The Code also establishes five Boards of Adjustment, one for each supervisorial district. The Boards of Adjustment are authorized to approve variances, issue temporary use permits, decide on appeals of administrative decisions, and decide on questions of interpretation of the Zoning Code.

Rezonings must be reviewed and analyzed by the Planning and Development Services Department. The Planning and Zoning Commission then reviews the proposal and conducts a public hearing. The recommendations of the commission are then transmitted to the Board of Supervisors which holds another public hearing and then makes the final decision on the rezoning.

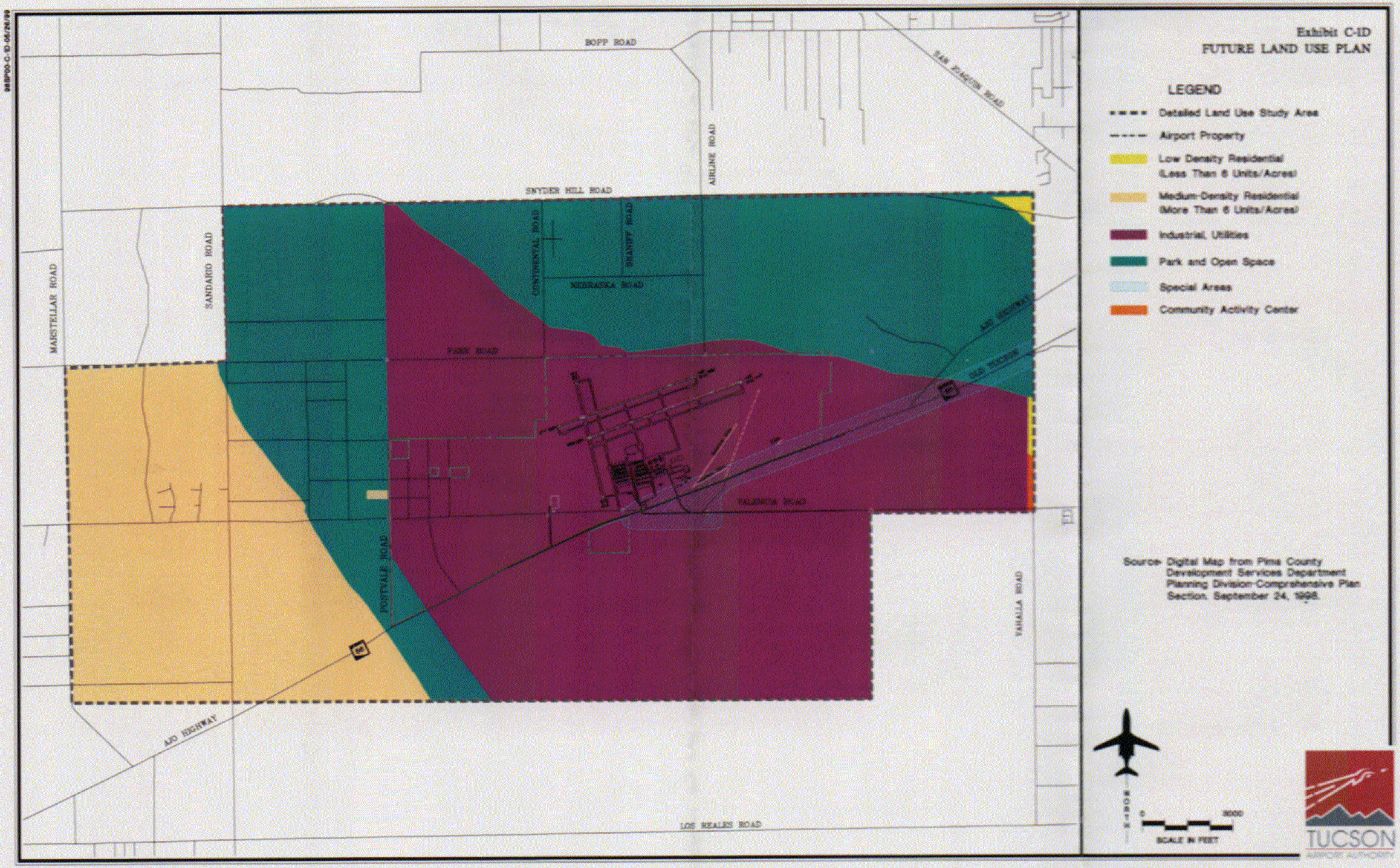
The Zoning Code provides a number of mechanisms for detailed review of development proposals and the negotiation of development concepts and details. The Code requires the filing of a detailed development plan for all developments involving more than three dwelling units on a single lot. The plan must show proposed building placement, easements, landscaping, and grading, among other things.

The Code also provides for the conditional approval of certain land uses. This involves the review of the proposed land use by a hearing administrator or the Board of Supervisors, depending on the type of use. Special conditions on the development may be imposed to protect the public interest.

The Code also establishes procedures for specific plans. This involves the preparation and approval of a detailed development plan for an area. It is approved by ordinance by the Board of Supervisors and becomes a special zoning district. All future development within the specific plan boundaries must conform to the details of the approved plan.

Chapter 18.57 of the Zoning Code has provisions for land use control near airports. Six special overlay zones are established to control the height of structures in airport environs and to regulate land uses within runway approach areas and within noise-impacted areas. These regulations apply to Tucson International Airport, Davis-Monthan Air Base, Pinal Airpark, and Ryan Field.

Exhibit C-ID
FUTURE LAND USE PLAN



The Airport Environs overlay districts applying in the Ryan Field vicinity are shown on **Exhibit C-1E**. These include the HOZ-Height Overlay Zone, and the RSZ and CUZ-2 compatible use overlay zones. These zones were established to *"regulate height and land use in the environs of civilian and military airports in order to ensure safe aircraft approach and departure, avoid the concentration of population in potential accident areas, and reduce the harmful effect of noise exposure on humans and animals."* Within the RSZ zone, crop raising is the only permitted use. Within the CUZ-2 zone, commercial, industrial, and institutional uses are permitted, although a number of uses which are sensitive to noise or which might compromise safety near the runway approaches are prohibited. These permitted and excluded uses are listed in **Table C-1B**. Residential uses in the CUZ-2 zone at Ryan Field are permitted if the density does not exceed one residence per acre.

The **Pima County Zoning Code** establishes twenty-four standard zoning districts and twelve overlay zoning districts. The provisions of these districts, as they apply to noise compatibility planning, are summarized in **Table C-1C**. A generalized zoning map is shown in **Exhibit C-1E**. In order to simplify the map and improve its legibility, the districts have been combined into larger, simpler categories on the map. **Table C-1D** shows how the zoning districts were assigned to the map categories.

Development Constraints

Development constraints in the Ryan Airfield study area are primarily composed of floodplains (including washes and dikes).

Pima County enforces floodplain zoning in conformance with the National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA). (See Floodplain and Erosion Control Ordinance No. 1988-FC-2 for Pima County, Arizona, 1988.) These regulations prohibit the construction of structures within the 100-year floodway, the area required to carry a 100-year flood. Within the floodway fringe, that part of the 100-year floodplain outside of the floodway, structures must be firmly anchored, raised above the 100-year flood level, and constructed to offer the minimum obstruction to the flow of flood waters.

Floodplains are shown in **Exhibit C-1F**. The entire airport property is located in the 100-year floodplain, fed by culverts and washes which flow northward to drain parcels south of Ajo Highway. All new structures built on the Ryan Airfield would need to conform with the Pima County Floodplain and Erosion Control Ordinance.

Two dikes located southeast of the main runway direct the main flow of a 100-year flood into washes east of the airfield. As a means to open this area for potential future development, an evaluation into the removal or relocation of the dikes has been presented. This general analysis has determined that removal of these dikes could be potentially damaging to airport infrastructure in the event of a 100-year flood. Consideration has also been given to the relocation of the existing dikes, pending the outcome of a potential future detailed hydraulic/ hydrologic study.

TABLE C-1B
Permitted Uses in the CUZ-2 Overlay Zone

Uses Per Pima County Code	
(a) Commercial, Industrial, and Institutional uses as per CB-1, CB-2, CPI, CI-1, CI-2, and CI-3, EXCEPT of the following: ▸ Amusement or recreational enterprises (indoor) ▸ Auctions ▸ Auditoriums or assembly halls ▸ Clubs ▸ Department stores ▸ Drive-in theaters ▸ Fairs, carnivals, or tent shows ▸ Grocery stores (except delicatessens and convenience stores) ▸ Gymnasiums ▸ Industrial or trade schools ▸ Hotels ▸ Libraries ▸ Racetracks ▸ Sports arenas or stadiums ▸ Religious rescue missions or temporary revivals ▸ Rifle ranges ▸ Schools or colleges ▸ Swimming pools ▸ Theaters ▸ Trade shows or exhibitions ▸ And within the first one thousand feet of the CUZ-2 zone (nearest the runway): retail and office uses are prohibited as primary uses.	
(b)	Enclosed sales and display areas incidental to light manufacturing and assembly.
(c)	Accessory uses for employees only (including cafeterias, offices, and indoor entertainment facilities).
(d)	Ryan Field only: Until the runway is realigned, residential uses not exceeding one residence per acre.
Source: **Pima County Zoning Code**, 1988, Section 18.57.030(c).	

98SP00-C-1E-06/28/99

BOPP ROAD

SAN JOAQUIN ROAD

AIRLINE ROAD

SNYDER HILL ROAD

MARSTELLAR ROAD

SANDARIO ROAD

CONTINENTAL ROAD

NEBRASKA ROAD

PARK ROAD

CUZ-2

RSZ

I-19

AJO HIGHWAY

OLD TUCSON

VALENCIA ROAD

POSTVALE ROAD

VARELA ROAD

LOS REALES ROAD

Exhibit C-1E

GENERALIZED AND AIRPORT ENVIRONS OVERLAY ZONING

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Single Family Residential
- Multiple Residential
- Rural Residential
- General Industrial
- General Business

AIRPORT ENVIRONS ZONES

- HOZ- Height Overlay Zone
- RSZ- Runway Safety Zone
- CUZ-2- Compatibility Use Zone

Source: Digital Map from Pima County Development Services Department Planning Division-Comprehensive Plan Section, September 24, 1998.

NORTH

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SCALE IN FEET

TUCSON AIRPORT AUTHORITY

99MP13-C-9'-06/26/99

ZONE A01

A02

ZONE A02

BOPP ROAD

SAN JOAQUIN ROAD

AIRLINE ROAD

SNYDER HILL ROAD

ZONE A01

MARSTELLAR ROAD

SANDARIO ROAD

CONTINENTAL ROAD

BRANIFF ROAD

NEBRASKA ROAD

ZONE A01

PARK ROAD

AJO HIGHWAY

OLD TUCSON

ZONE X

ZONE A03

ZONE A02

ZONE A01

VALENCIA ROAD

POSTVALE ROAD

ZONE A

VAHALLA ROAD

AJO HIGHWAY

LOS REALES ROAD

Exhibit C-1F
FLOODPLAINS MAP

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Zone A- No Base Elevations Determined Within This Area
- Zone AO1- Base Flood Depth of 1 Feet, Above Ground Elevation
- Zone AO2- Base Flood Depth of 2 Feet, Above Ground Elevation
- Zone AO3- Base Flood Depth of 3 Feet, Above Ground Elevation
- Zone X- Outside of 500-Year Floodplain
- Riparian Habitat

Source: National Flood Insurance Program, Flood Insurance Rate Maps: 04019C2600 K & 04019C2200 K, Dated February 8, 1999.

NORTH

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SCALE IN FEET

TUCSON
AIRPORT AUTHORITY

Exhibit C-2B

CONSOLIDATED DEPARTURE TRACKS

BOPP ROAD

SNYDER HILL ROAD

AIRLINE ROAD

SWAN/WILMOT ROAD

MARSTELLAR ROAD

SANDARIO ROAD

CONTINENTAL ROAD

BRANDY ROAD

NEBRASKA ROAD

PARK ROAD

I-10

OLD TUCSON

VALENCIA ROAD

POSTVALE ROAD

SR 86

AJO HIGHWAY

LOS REALES ROAD

YAHALLA ROAD

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Consolidated Departure Track Spines
- Departure Sub-Tracks
- Single Family Residential
- Multi-Family Residential
- Mobile Home
- Public
- Airport Property
- Commercial
- Industrial, Transportation
- Open Space

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998.

NORTH

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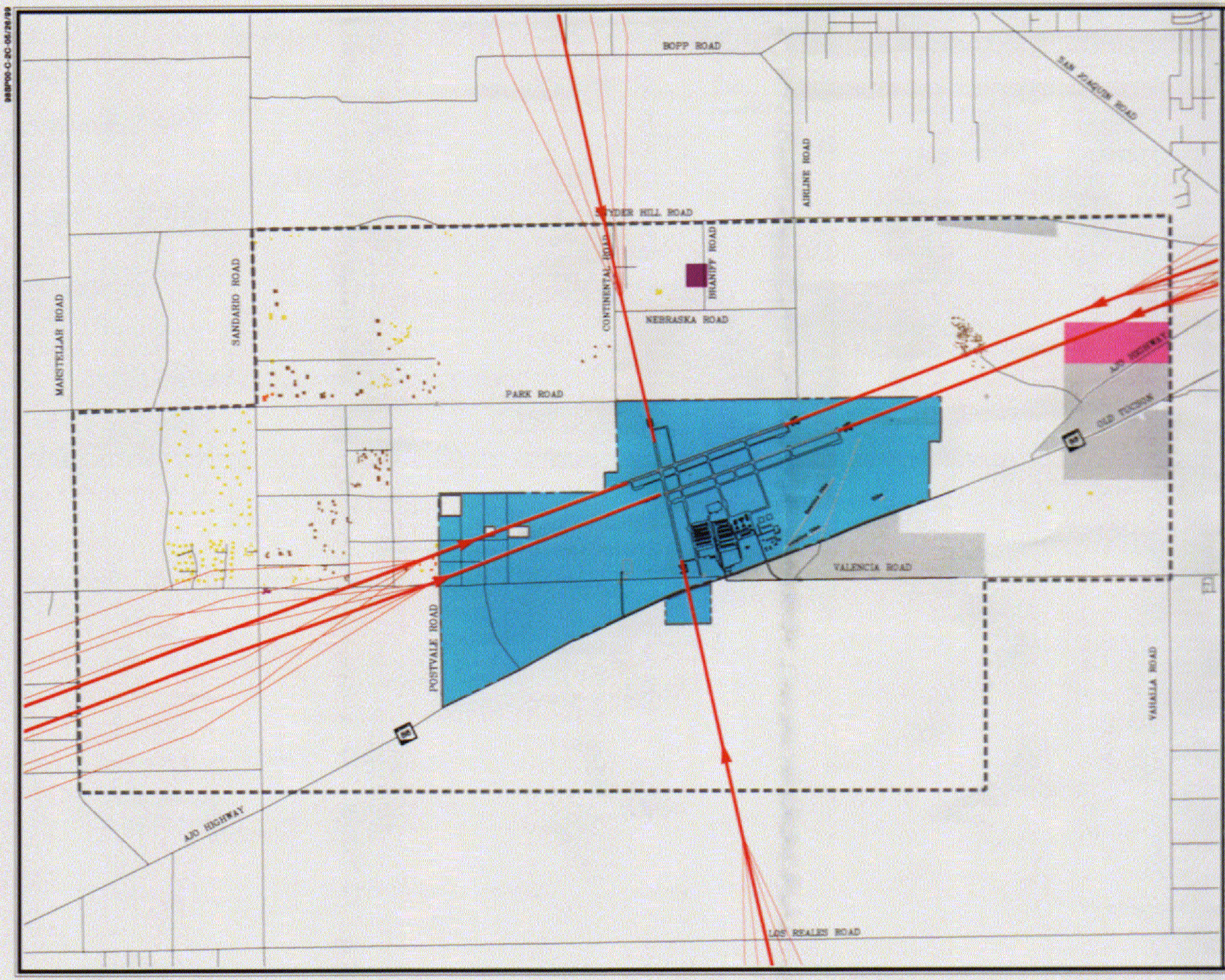
SCALE IN FEET

TUCSON AIRPORT AUTHORITY

BSP00-C-2C-05/24/99

Exhibit C-2C
CONSOLIDATED ARRIVAL TRACKS



LEGEND

- Detailed Land Use Study Area
- Airport Property
- Consolidated Arrival Track Spines
- Arrival Sub-Tracks
- Single Family Residential
- Multi-Family Residential
- Mobile Homes
- Public
- Airport Property
- Commercial
- Industrial, Transportation
- Open Space

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998.

NORTH

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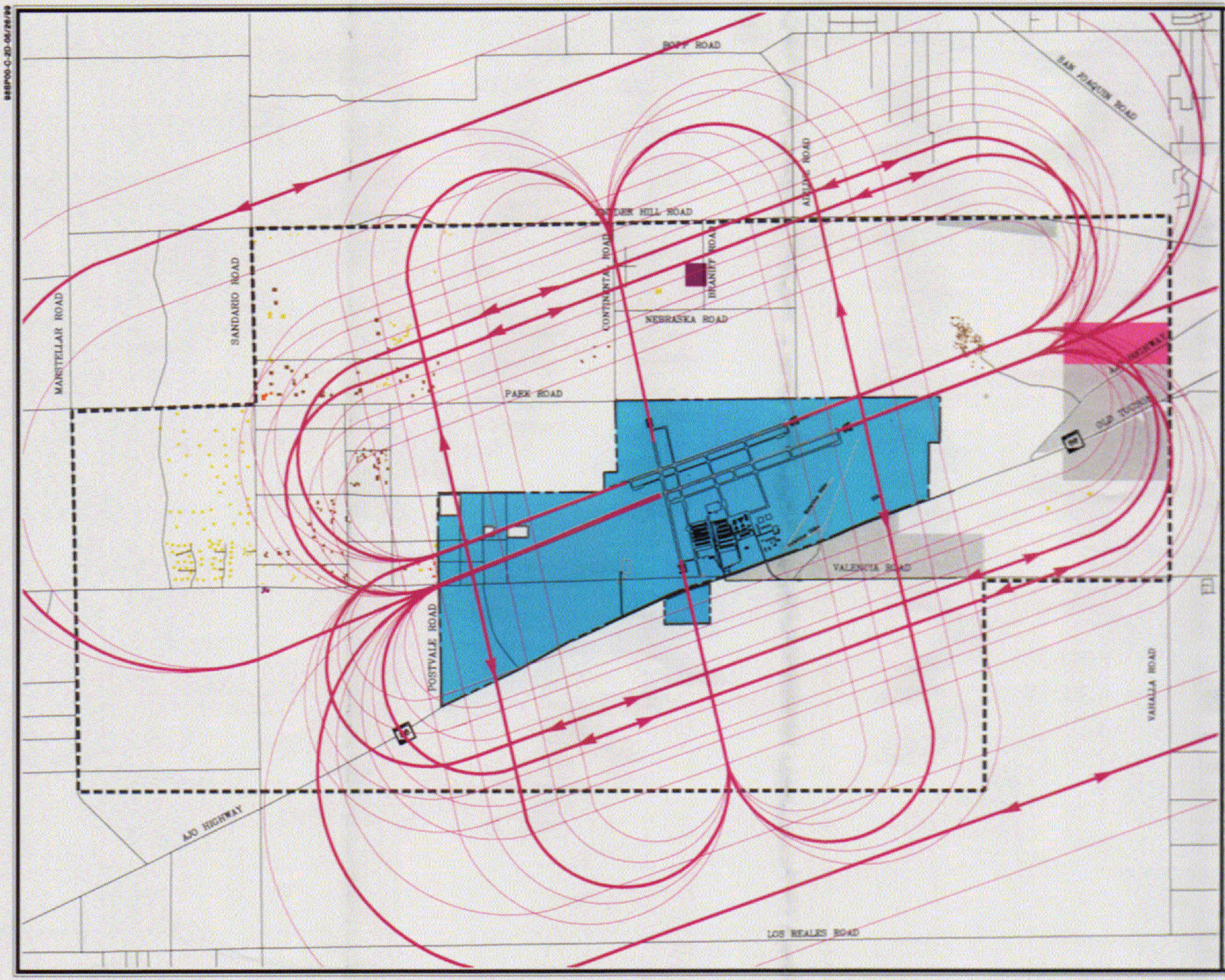
SCALE IN FEET

TUCSON AIRPORT AUTHORITY

Exhibit C-2D

CONSOLIDATED TOUCH-AND-GO TRACKS



LEGEND

- Detailed Land Use Study Area
- Airport Property
- Consolidated Touch-And-Go Track Spines
- Touch-and-Go Sub-Tracks
- Single Family Residential
- Mult-Family Residential
- Mobile Home
- Public
- Airport Property
- Commercial
- Industrial, Transportation
- Open Space

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998.

NORTH

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SCALE IN FEET

TUCSON AIRPORT AUTHORITY

TABLE C-1C
Summary of Zoning Provisions:
Pima County

Zoning Districts	Noise-Sensitive Uses: Permitted	Noise-Sensitive Uses: Conditional	Minimum Lot Size or Density Units/Acre
RURAL DISTRICT			
IR, Institutional Reserve Zone	Single-family dwelling Manufactured or mobile home Farm labor housing Guest dwelling Public School Places of worship Health care clinic	Minor Resort Museum Private School	36 acres[2].
RH, Rural Homestead Zone	Single-family housing Manufactured or mobile home Guest Dwelling Public school Places of worship Child care center Group foster home Health clinic	Minor resort Private school Museum Rest home Manufactured home park Cluster development	180,000 ft^2.
GR-1, Rural Residential Zone	Same as RH	Same as RH	36,000 ft^2.
SR, Suburban Ranch Zone	Single-family Places of worship Public school	Minor resort College Private school Residential substance abuse diagnostic and treatment facility Library Museum Cluster development	144,000 ft^2.
SH, Suburban Homestead Zone	Duplex Manufactured or mobile home Others per SR	Manufactured home park Cluster development Others per SR	18,000 - 36,000 ft^2. *
RESIDENTIAL DISTRICTS			
TH, Trailer Homesite Zone	Single-family dwelling manufactured or mobile home Trailer park	--	2,000 ft^2.
ML, Mount Lemmon Zone	Private school other than parochial Others per SR	Cluster development	36,000 ft^2.
CR-1, Single Residence Zone	Private school College Others per SR	Same as ML	36,000 ft^2.
CR-2, Single Residence Zone	Same as CR-1	Same as CR-1	16,000 ft^2.
CR-3, Single Residence Zone	Same as CR-2	Same as CR-2	8,000 ft^2.

TABLE C-1C (Continued)
Summary of Zoning Provisions:
Pima County

Zoning Districts	Noise-Sensitive Uses: Permitted	Noise-Sensitive Uses: Conditional	Minimum Lot Size or Density Units/Acre
RESIDENTIAL DISTRICTS (Continued)			
CR-4, Mixed-Dwelling Type Zone	Duplex Multiple dwelling Private school Others per SR	--	3,500 - 7,000 ft^2. *
CR-5, Multiple Residence Zone	Same as CR-4	--	2,000 - 6,000 ft^2.
TR Transitional Zone	College Library Museum Hospital or sanatorium Child care center Motel or hotel Other residential Others per CR-5	--	1,000 - 10,000 ft^2. *
CMH-1, County Manufactured and Mobile Home-1 Zone	Single family residential Places of worship Manufactured or mobile home Private school College Health clinic Child care center Library Museum	Cluster development	8,000 ft^2.
CMH-2, County Manufactured and Mobile Home-2 Zone	Child care center Places of worship Museum Others per CMH-1	--	3,500 ft^2.
BUSINESS DISTRICTS			
MR, Major Resort Zone	Major resort	--	--
RVC, Rural Village Center Zone	Child care center Places of worship Clinic Library Museum	--	--
CB-1, Local Business Zone	Trade and craft schools Places of worship Library Others per TR	--	1,000 - 10,000 ft^2. *
CB,2 General Business Zone	Auditorium Others per CB-1	--	1,000 - 7,000 ft^2. *

TABLE C-1C (Continued)
Summary of Zoning Provisions:
Pima County

Zoning Districts	Noise-Sensitive Uses: Permitted	Noise-Sensitive Uses: Conditional	Minimum Lot Size or Density Units/Acre
INDUSTRIAL DISTRICTS			
MU, Multiple Use Zone	Single family Duplex Places of worship Public school Multiple dwelling Manufactured or mobile home Trailer or trailer court Boarding/rooming house Private school other than parochial College Hospital or sanatorium	--	3,500-7,000 ft^2. *
CPI, Campus Park Industrial Zone	Child care centers	--	--
CI-1, Light Industrial/Warehouse Zone	Auditorium Trade school Commercial School Hotel	Public assembly facility	--
CI-2, General Industrial Zone	Doctors office or clinic Others per CI-1	--	--
CI-3, Heavy Industrial Zone	--	--	--
OVERLAY ZONES			
GC, Golf Course	--	--	--
HD, Hillside Development	--	--	--
H-1, Historic Zone-1	--	--	--
H-2, Historic Zone-2	--	--	--
AE, Airport Environs and Facilities **	--	--	--
BZ, Buffer Overlay Zone	--	--	-

* The larger number is the minimum lot size. The smaller number is the minimum lot area per dwelling unit for duplex and multi-family dwellings.

** Within the AE overlay zone, six other overlay zones have been established -- RSZ, MCZ, CUZ-1, CUZ-2, CUZ-3, and CUZ-4.

Source: The Pima County Zoning Code, 1998

TABLE C-1D Classification of Zoning Districts	
Generalized Pima County Zoning Districts	
Single-Family Residential	TH, Trailer Homesite Zone ML, Mount Lemmon Zone CR-1, Single Residence Zone CR-2 Single Residence Zone CR-3 Single Residence Zone CMH-1, County Manufactured and Mobile Home-1 Zone CMH-2, County Manufactured and Mobile Home-2 Zone
Multiple Residential	CR-4, Mixed-Dwelling Type Zone CR-5, Multiple Residence Zone TR Transitional Zone
Rural Residential	IR, Institutional Reserve Zone RH, Rural Homestead Zone GR-1, Rural Residential Zone SR, Suburban Ranch Zone SH, Suburban Homestead Zone
General Industrial	MU, Multiple Use Zone CPI, Campus Park Industrial Zone CI-1, Light Industrial/Warehouse Zone CI-2, General Industrial Zone
General Business	MR, Major Resort Zone RVC, Rural Village Center Zone CB-1, Local Business Zone CB-2, General Business Zone

Further development constraints are posed by the presence of a designated Riparian Habitat associated with several unnamed washes on the eastern side of airport property. Any proposed alteration of these habitats would require a Mitigation Plan and rational explaining the absence of alternative options, per Pima County Code.

SUBDIVISION REGULATIONS

Subdivision regulations apply in cases where a parcel of land is proposed to be divided into lots or tracts. They are established to ensure the proper arrangement of streets, adequate and convenient open space, efficient movement of traffic, adequate and

properly located utilities, access for fire-fighting apparatus, avoidance of congestion, and the orderly and efficient layout and use of land.

Subdivision regulations can be used to enhance noise-compatible land development by requiring developers to plat and develop land so as to minimize noise impacts or reduce the noise sensitivity of new development. The regulations can also be used to protect the airport proprietor from litigation for noise impacts at a later date. The most common requirement is the dedication of a noise or avigation easement to the local government by the land subdivide as a condition of development approval. The easement authorizes overflights of the property, with the noise levels attendant to such operations. It also requires the developer to provide noise insulation in the construction of the buildings.

Pima County administers subdivision regulations in the study area. The regulations, which are set forth in Chapter 18.69 of the zoning code, do not include any special requirements pertaining to airport noise.

BUILDING CODES

Building codes regulate the construction of buildings, ensuring that they are built to safe standards. Building codes may be used to require noise insulation in new residential, office, and institutional building construction when warranted by existing or potential high aircraft noise levels.

Pima County administers the 1994 edition of the Uniform Building Code (UBC) promulgated by the International Conference of Building Officials. However, it does establish uniform insulation performance standards to protect persons with hotels, motels, apartment houses, attached and detached sing-family dwellings, and within other buildings where noise-sensitive activities are affected by excessive aircraft noise.

CAPITAL IMPROVEMENTS PROGRAMS

Capital improvements programs are multi-year plans, typically covering five or six years, which list major capital improvements planned to be undertaken during each year. Most capital improvements have no direct bearing on noise compatibility. The obvious exceptions to this are schools and, in certain circumstances, libraries, medical facilities, and cultural and recreational facilities.

Some capital improvements exert a strong influence on development trends and may have an important indirect relationship to noise compatibility. For instance, sewer and water facilities may open up large vacant areas for residential development. In contrast, the same types of facilities, sized for industrial users, could commit to industrial development a noise-impacted area that might otherwise be attractive for residential development on septic systems.

Pima County has a five-year Capital Improvements Program. Currently, the program proposes no Capital Improvement Projects in the study area.

Previous Noise Compatibility Study

The previous Noise Compatibility Plan was completed in 1990. The primary objective of this Plan was to improve the compatibility between Tucson Ryan Airfield aircraft operations and noise-sensitive environs, while allowing the airport to continue to serve its role in the community, region and nation. The Plan contained three closely related programs aimed at satisfying this objective: the aviation noise abatement plan, land use management plan, and implementation plan.

PREVIOUS NOISE COMPATIBILITY STUDY

The previous Noise Compatibility Plan was completed in July 1990. The primary objective of the Plan was to improve the compatibility between Ryan Airfield aircraft operations and noise-sensitive land uses within the airport environs, while allowing the airport to continue to serve its role in the community, region, and nation. The Plan contained two closely related program measures aimed at satisfying this objective: noise abatement measures, and land use management alternatives.

Although no noise abatement measures were recommended in the previous Plan, the following were given as possible considerations towards noise abatement alternatives:

NA-1: Construction of a 2,800 foot extension of Runway 6R/24L ultimately extending this runway to the east. In addition, the construction of a 4,900 foot parallel Runway 6L/24R which would be displaced 700 feet to the north.

Status: Runway 6R/24L has been extended to the east by 2,800 feet. An additional 4,900 foot runway (Runway 6L/24R) was constructed in 1993, 700 feet north and west of Runway 6R/24L as suggested in NA-2.

NA-2: As an option to runway configuration to NA-1, Runway 6R/24L could be extended to the west. The location of the additional parallel Runway 6L/24R would be moved further west in this option compared to NA-1.

Status: Not implemented. (See status for NA-1.)

NA-3: A second runway configuration option considered was abandoning Runway 6R/24L and replacing it with an 8,300 foot runway located near the east end of the Runway 6L/24R. An additional parallel 4,900 foot runway would be constructed 700 feet south in this option.

Status: Not implemented. (See status for NA-1.)

NA-4: A third runway configuration option considered was a new 8,300 foot runway 700 feet south of Runway 6L/24R and extending 1,500 feet west of Runway 15-33. This option also considered converting Runway 6L/24R from the main runway to a secondary runway.

Status: Not implemented. (See status for NA-1.)

NA-5: As a means of marketing Ryan Airfield as an airline training facility, a runway configuration identical to that in NA-1 would be beneficial. Such an anticipated training facility would utilize nine single engine and six multi-engine aircraft performing 8,000 annual flight operations each.

Status: International Airline Pilots Training (IAPT) is utilized by KLM Airlines for preliminary pilot flight training. The school uses a 10,000 square foot facility along with a 10,500 square foot apron. Space is available for up to 20 single and multi-engine piston driven aircraft.

Land Use Management Strategies

The following land use management strategies were recommended in the previous Plan:

LU-1: Pima County should maintain existing industrial and commercial zoning areas beneath commonly used flight tracks at Ryan Airfield. Consider industrial rezonings of land designated for industrial use in the Southwest Area Plan, consistent with the recommendations in the Black Wash Drainage Analysis and Policy Assessment Report.

Status: The Southwest Area Plan was subsumed by the Pima County Comprehensive Plan in 1992. This Plan designates the area surrounding Ryan Airfield as Urban Industrial (I) on the Comprehensive Plan. This Industrial classification supports rezoning to Commercial (CB-1 & CB-2) and Industrial (CPI, CI-1 & CI-2). The study area also contains an designated Special Area (Special Area Plan Policy 2-01), for encouraging specific airport related land uses.

LU-2: Pima County should maintain existing airport environs overlay zoning. Make adjustments in zoning boundaries to reflect runway layout recommendations of the Airport Master Plan. Consider prohibiting residential use or increasing the minimum lot size for residences in the CUZ-2 zone.

Status: Pima County has continued to maintain airport environs overlay zoning in conjunction with Ryan Airfield. This was updated in 1992 and included an expansion of the RSZ and CUZ-1 overlay zoning areas to reflect airport configuration changes adopted from the previous Airport Master Plan.

Pima County chose to increase the minimum lot size to one acre instead of prohibiting residential development in the CUZ-2 zone.

LU-3: Pima County should adopt the recommendation of the Black Wash Drainage Analysis and Policy Assessment Report, defining a regulatory floodway north and east of Ryan Airfield and promoting the preservation of that area in its natural state.

Status: The Black Wash Drainage Analysis and Policy Report was adopted in by the county in September 1990. The area surrounding the wash is designated as Resource Conservation (RC) in the Pima County Comprehensive Plan. This designation

supports rezonings to Institutional Reserve (IR), Rural Homestead (RH), and Suburban Ranch (SH).

LU-4: Pima County should amend subdivision regulations to require the recording of a note with the final plat review within the AE and CUZ-2 overlay zones stating the risk of aircraft overflights and high noise level.

Status: Subdivision reviews require a note stating the potential of high noise, on the final plat, if the subdivision is located in an Airport Environs Zone (AE) or Compatible Use Zone (CUZ). A note specifically stating "risks" associated with close proximity to the airport is not required.

LU-5: Pima County should amend the Southwest Area Plan by adopting the Part 150 Noise Compatibility Plan, or parts of the 150 Plan. An alternative could be the adoption of the Part 150 Plan as a general planning guideline.

Status: The Southwest Area Plan was subsumed by the Pima County Comprehensive Plan in 1992. The Comprehensive Plan doesn't specifically address issues pertaining to noise compatibility issues. Pima County also has not officially adopted the previous Part 150 Plan for general planning guidance.

LU-6: Pima County should consider special review procedures for evaluating subdivision, rezoning, special use, conditional use and variance request within the airport environs overlay zones.

Status: Special Review procedures have not been adopted for evaluating request within the Airport Environs Zone. Considerations pertaining to development in this zone have been integrated into the standard review procedures.

SUMMARY

The information discussed in this chapter provides a foundation upon which the remaining elements of the planning process will be constructed. Information on current airport facilities and utilization serve as a basis for the development of the aircraft noise analyses during the next phase of the study. This information will, in turn, provide guidance to the assessment of potential changes to aviation facilities or procedures necessary to meet the goals of the planning process. The inventory of the airport environs will allow the assessment of airport noise impacts.

DOCUMENT SOURCES

A variety of different documents were referenced in the inventory process. The following listing reflects a partial compilation of these sources. The listing does not include the data provided directly by the Tucson Airport Authority staff or airport drawings which were referenced for information. An on-site inventory was also conducted to review the existing facilities for the master planning effort.

Aeronautical Information Manual/Federal Aviation Regulations; McGraw Hill, 1998 Edition.

Airport Facility Directory, Southwest United States; U.S. Department of Commerce, National Oceanic and Atmospheric Administration, October 8, 1998 Edition.

Phoenix Sectional Aeronautical Chart; U.S. Department of Commerce, National Oceanic and Atmospheric Administration, May 21, 1998.

Pima County Comprehensive Plan; Pima County Development Services Department, Planning Division, Adopted October 1992, Revised December 1996.

Regional Economic Information System; U.S. Department of Commerce, Economics and Statistics Administration, Bureau of Economic Analysis, Regional Economic Measurement Division.

Regional Aviation System Plan Update; Pima Association of Governments, Airport Technology and Planning Group, Inc., February, 1995.

Ryan Airfield Airport Master Plan; Tucson Airport Authority, Coffman Associates, July 1990.

Ryan Airfield Treatment Management Program Update; Appendix C, Tucson Airport Authority, Pavement Consultants, Inc. August, 1997.

U.S. Terminal Procedures, Southwest, Volume 1 of 2; U.S. Department of Commerce, National Oceanic and Atmospheric Administration, October 8, 1998 Edition.

The following Web pages were also visited for information during the preparation of the inventory:

www.airnav.com
www.ci.tucson.az.us
www.co.pima.az.us
www.dot.co.pima.az.us
www.futurewest.com
www.tucsonairport.org
www.tusdk12.az.us

Appendix C-2
AVIATION NOISE

This chapter describes the methods and key input assumptions used to update the noise exposure maps for Ryan Airfield. This study develops noise contour maps for three study periods: current, short term, and long term planning horizons. The 1999 noise contour map shows the current noise levels based on current operations. Forecast operations levels from the concurrent Master Plan update form the basis for the short term 2004 noise contour map. The long term 2020 noise contour map presents a view of potential future noise exposure at Ryan.

AIRCRAFT NOISE ANALYSIS METHODOLOGY

The standard methodology for analyzing the prevailing noise conditions at airports involves the use of a computer simulation model. This study uses the Integrated Noise Model which the Federal Aviation Administration (FAA) has approved for evaluating aircraft noise impacts in the vicinity of airports.

The Volpe National Transportation Systems Center of the U.S. Department of Transportation at Cambridge, Massachusetts developed the Integrated Noise Model (INM). The Department of Transportation designed the INM as an average-value model for estimating long-term average noise levels using average annual input data. The FAA sponsors the continuous revision and updating of the model. More than 700 organizations in 35 countries have used various versions of the INM computer program since 1978. This study uses version 5.2a of the INM for the noise analysis described in this chapter.

The INM works by defining a network of grid points at ground level around the airport. It then selects the shortest

distance from each grid point to each flight track and computes the noise exposure for each aircraft operation, by aircraft type and engine thrust level, along each flight track. The model applies corrections for air-to-ground attenuation, acoustical shielding of the aircraft engines by the aircraft itself, and aircraft speed variations. The model then sums the noise exposure levels for each aircraft at each grid point location. The cumulative noise exposure levels at all grid points form the basis for the noise exposure contours. The program can then plot noise contour maps using a wide variety of metrics. This study uses the Day-Night Equivalent Sound Level, DNL, metric.

In addition to its mathematical capabilities, the model contains a data base which consists of tables correlating noise, thrust settings, and flight profiles for most of the civilian aircraft and many of the common military aircraft operating in this country. The FAA sponsored and guided the development of this data base, often referred to as the noise curve data, is based on rigorous noise monitoring in controlled settings. Extensive research and field measurements went into the development of the data base. The data base provides the information which allows the model to compute airport-specific flight profiles.

INM INPUT

The Integrated Noise Model requires a wide variety of user-supplied input data. Typical input data includes: airport elevation, average annual temperature, a mathematical description of the airport runways, a numeric description of the ground tracks above which the aircraft fly, and the assignment of specific aircraft with specific engine types at specific takeoff weights to individual flight tracks. The model has provisions for defining aircraft other than those in the data base, however, the FAA must review and approve any substitutions or user-defined aircraft. **Exhibit C-2A** summarizes the INM Process.

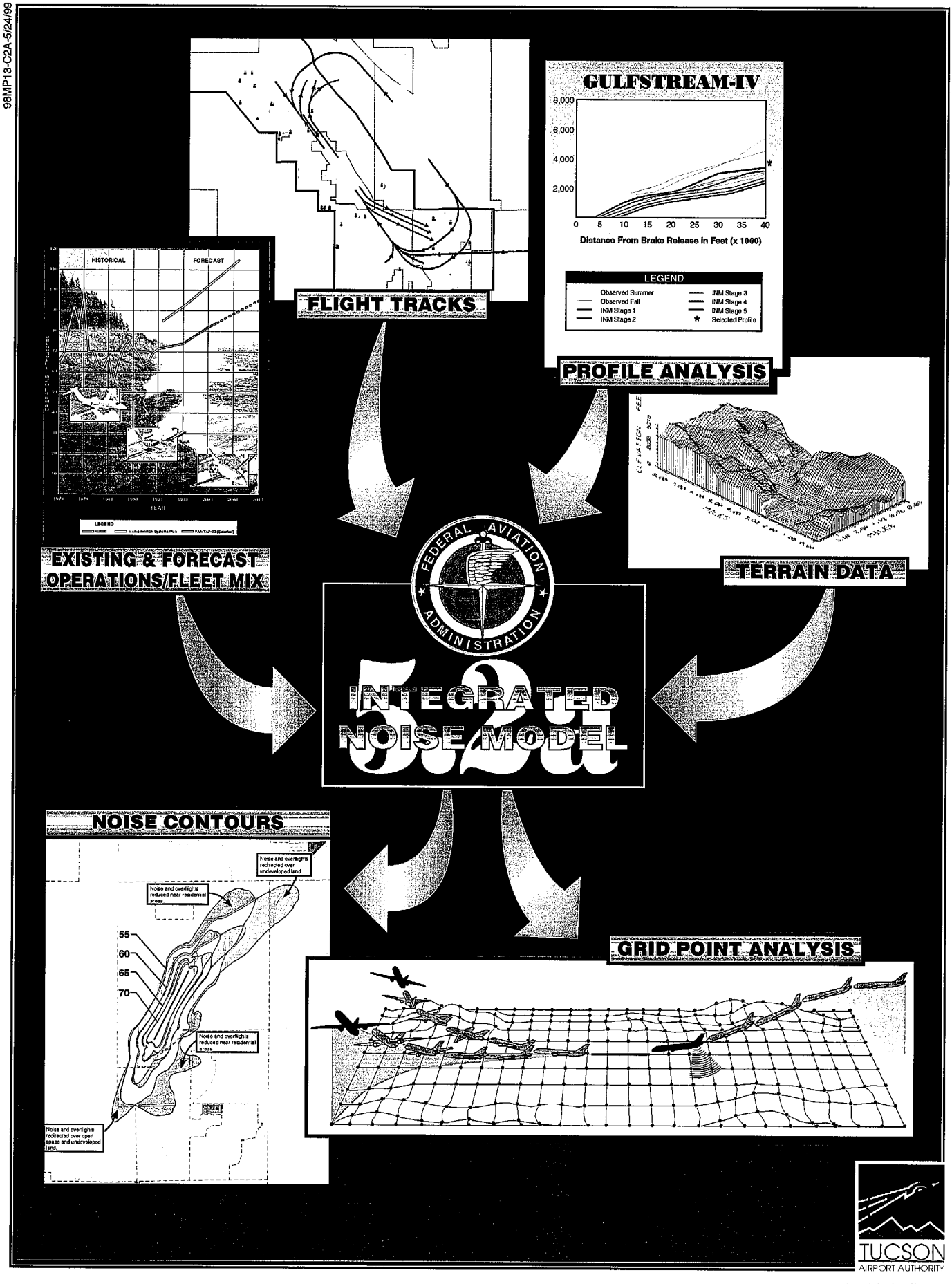
Activity Data

This study uses current and forecast operations (takeoffs and landings) data from the concurrent Master Plan Update. **Table 2K,** *on page 2-16 in the Ryan Airfield Master Plan,* summarizes the operations data. The annual operations data in the table is divided by 365 to get the average daily operations data required for input to the model.

FLEET MIX

The Master Plan provided an analysis of the based aircraft fleet mix. That information formed the basis for the fleet mix input data for the noise analysis. **Table 2E,** *on page 2-10 in the Ryan Airfield Master Plan,* presents the current and forecast fleet mix from the Master Plan. **Table C-2A** summarizes the fleet mix and annual aircraft operations.

98MP13-C2A-5/24/99



TUCSON AIRPORT AUTHORITY

Exhibit C-2A
INM PROCESS

TABLE C-2A
Annual Operations by Aircraft Type
Ryan Airfield

	1999	2004	2020
ITINERANT OPERATIONS			
Light Single-variable pitch propeller	35,800	41,308	60,693
Light Single-fixed pitch propeller	8,637	10,669	15,818
Twin Engine	2,947	3,556	5,613
Multi-Engine	1,000	1,000	1,000
Turboprop	150	1,200	3,600
Jet	50	600	2,000
Helicopter	416	667	1,276
Military	615	1,000	1,000
Sub-total, Itinerant operations	49,615	60,000	91,000
LOCAL OPERATIONS			
Light Single-variable pitch propeller	79,726	92,459	126,774
Light Single-fixed pitch propeller	19,932	23,115	31,693
Light Twin	6,342	7,426	10,533
Military	449	1,000	1,000
Sub-total, local operations	106,449	124,000	170,000
TOTAL OPERATIONS	156,064	184,000	261,000

DATA BASE SELECTION

Because single-engine aircraft in the general aviation fleet vary widely in their noise characteristics, the INM utilizes two composite single-engine models. The FAA's substitution list indicates that the general aviation single engine variable pitch propeller model, the GASEPV, represents a number of single-engine general aviation aircraft such as: Beech Bonanza, Cessna 177 and 180, Piper Cherokee Arrow, Piper PA-32, and the Mooney. The general aviation single-engine fixed pitch propeller model, the GASEPF, also represents several single-engine general aviation aircraft such as: Cessna 150 and 172, Piper Archer, Piper PA-28-140 and -180, and the Piper Tomahawk.

The list recommends the BEC58P, typically the Beech Baron, to represent the light twin-engine aircraft such as the Piper Navajo, Beech Duke, Cessna 310, and others. The CNA441, typically the Cessna 441, effectively represents the light turboprop aircraft such as the Beech King Air, Cessna 402, Gulfstream Commander and others. For future years, the CNA500

represents the light business jet types most likely to use the airfield. The DC6 designator represents the four, multi-engine, C-54 aircraft based on the field.

The FAA's Heliport Noise Model (HNM) provided information for helicopter modeling. Data extracted from the HNM for the Bell 206, served to simulate helicopter operations at the airport. Due to the proximity of Davis-Monthan AFB as well as the presence of several nearby military operations areas,(MOA's), military operations at Ryan fluctuate with various missions. The OV-10 is the most common military aircraft using the airfield and is represented by the INM designator DHC6.

These choices conform to the Pre-Approved Substitution List published by the FAA Office of Environment and Energy (AEE) branch in Washington.

Flight Profiles

The INM program uses a three-degree approach as the standard arrival profile. Nothing in the inventory interviews for the Master Plan or in the published airport information indicates any variation in this standard procedure at Ryan. Therefore, the models in this study use the standard approach procedure as representative of local operating conditions.

The INM computes takeoff profiles based on the user-supplied airport elevation and the average annual temperature entries in the input data. Ryan Airfield lies at 2403 feet mean sea level (MSL) with an average annual temperature of 50.4 degrees F. The INM automatically computes the takeoff profiles using the airplane performance coefficients in the data base and the equations in the Society of Automotive Engineers Aerospace Information Report 1845 (SAE/AIR 1845). The INM computes separate departure profiles (altitude at a specified distance from the airport with associated velocity and thrust settings) for each of the various types of aircraft using the airport.

Time of Day

The INM attaches special significance to the time of day at which operations occur because of the extra weighting of nighttime flights. In calculating airport noise exposure, one nighttime operation has the same noise emission value as 10 daytime operations (a weight of 10 extra decibels). At Ryan, the Air Traffic Control Tower is operated from 6 a.m. to 8 p.m. in the summer and 6a.m. to 6 p.m. in the winter and the airport closes Runway 6L-24R from sunset to sunrise. These field limitations also limit statistics on nighttime activity. Recognizing that nighttime flying constitutes an important part of any flight training program, a representative model must show some activity at night. Based on interviews with airport management, the noise exposure models in this study assume one percent of total operations occur between the hours of 10 p.m. and 7 a.m.

Runway Use

For modeling purposes, wind data analysis usually determines runway use percentages. However, wind analysis provides only the directional availability of a runway and does not consider pilot selection, primary runway operation, or local operating conventions. At Ryan, local operating convention designates Runways 6R and 6L as the preferential runways up to a 10 knot tailwind. Wind rose analysis indicates that winds of 0 to 10 knots occur approximately 83 percent of the time. That added to the 5 percent of the time that winds stronger than 10 knots favor Runways 6L and 6R, gives a runway use of 88 percent for these runways. Given this preferential runway use program, aircraft may use Runways 24R and 24L approximately 10 percent of the time. Runways 15 and 33 each accommodate one percent of the operations. **Table C-2B** shows the runway use percentages for the noise exposure models of this study.

TABLE C-2B
Runway Use Percentages
Ryan Airfield

Runway	Turboprop, Bizjet, Military, other large aircraft	Light Singles, Light Twins, Rotorcraft
6R	88	44
24L	12	5
6L	0	44
24R	0	5
15	0	1
33	0	1

Flight Tracks

Conversations with airport management personnel and a review of the previous FAR Part 150 study provided the basis for flight track determination. Observed itinerant departures turn right or left to destination headings when using any runway, therefore, the models in this study do not use straight-out departures. However, all arrival tracks were modeled on straight-in tracks. Airport directives prescribe left-hand operations for the local training pattern on all runways and the technician encoded these tracks accordingly.

Although the consolidated flight tracks shown on **Exhibits C-2B, C-2C and C-2D** appear as distinct paths, they actually represent average flight routes and illustrate the areas where aircraft operations most likely will occur. As the exhibit shows, air traffic density generally increases nearer the airport

as the aircraft funnel-in to and disperse from the runway system. The tracks presented on the accompanying exhibit do not represent the only flight paths used. Variations by individual aircraft along these tracks may occur based on pilot technique, aircraft type, weather conditions, and air traffic control needs. Generally speaking, an observer may expect to see an aircraft almost anywhere in the sky around the airport.

Assignment Of Aircraft To Flight Tracks

The assignment of aircraft and their related operations values to specific flight tracks completes the input data for the INM. No predominate destination heading emerged from the inventory interviews or from a review of the previous study. Therefore, the technician split itinerant departure operations equally between north and south turning departure tracks off the main 6L/R-24R/L runway system. The previously discussed runway use assumptions based on wind and the preferential runway use program dictated the assignment of aircraft and operations to the itinerant arrival tracks and to the touch-and-go tracks (local training pattern). In general, the technician factored the number of operations by a specific aircraft by the runway use, the directional assignment, and the time of day. That process continued to cover the assignment of all operations to flight tracks.

INM OUTPUT

The INM offers a wide variety of metrics as output options. For this study, average annual noise contours in DNL are required. F.A.R. Part 150 requires 65, 70, and 75 DNL contours for the official Noise Exposure Maps. The following paragraphs present the results of the contour analysis for current and forecast noise exposure conditions as developed from the Integrated Noise Model.

1999 Noise Exposure Contours

Exhibit C-2E presents the plotted results of the INM contour analysis for 1999 conditions using input data described in the preceding pages. **Table C-2C** shows the surface areas within each contour.

The overall shape of the noise pattern around the airport shows the effects of the preferential runway use program. The contours extend to the east, reflecting the higher portion of departures using Runways 6L and 6R.

The pointed shape which extends west of the west end of Runway 6R represents departure noise. The 65, 70, and 75 DNL contours, except for a very small portion, remain on airport property. The 65 DNL contour escapes airport property on the north side near Airline Road, and on the west side, just north and west of the end of Runway

s68P00-C-3B-06/26/99

BOPP ROAD

SAN JOAQUIN ROAD

AIRLINE ROAD

SNYDER HILL ROAD

MARSTELLAR ROAD

SANDARIO ROAD

CONTINENTAL ROAD

BRANIFF ROAD

NEBRASKA ROAD

PARK ROAD

AJO HIGHWAY

OLD TUCSON

75

70

65

VALENCIA ROAD

POSTVALE ROAD

YAHALLA ROAD

AJO HIGHWAY

LOS REALES ROAD

Exhibit C-3B

1999 AIRCRAFT NOISE EXPOSURE WITH LAND USE

LEGEND

- Detailed Land Use Study Area
- Airport Property
- DNL Contour, Significant Effect
- Single Family Residential
- Multi-Family Residential
- Mobile Home
- Open Space

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998. Updated by Coffman Associates, March 1999.

0 3000

SCALE IN FEET

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98SP00-C-3C-06/28/99

Exhibit C-3C
2004 AIRCRAFT NOISE EXPOSURE WITH LAND USE

BOPP ROAD
SAN JOAQUIN ROAD
AIRLINE ROAD
SNYDER HILL ROAD
CONTINENTAL ROAD
BRANIFF ROAD
NEBRASKA ROAD
MARSTELLAR ROAD
SANDARIO ROAD
PARK ROAD
I-10
OLD TUCSON
AJO HIGHWAY
VALENCIA ROAD
POSTVALE ROAD
VARELA ROAD
LOS REALES ROAD

75
70
65

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Ultimate Property Line
- DNL Contour, Significant Effect
- Single Family Residential
- Multi-Family Residential
- Mobile Home
- Open Space

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998, Updated by Coffman Associates, March 1999.

NORTH

0 3000

SCALE IN FEET

TUCSON AIRPORT AUTHORITY

98BP00-C-3D-08/26/99

BOPP ROAD

SAN JOAQUIN ROAD

AIRLINE ROAD

SNYDER HILL ROAD

MARSTELLAR ROAD

SANDARIO ROAD

CONTINENTAL ROAD

BRANIFF ROAD

NEBRASKA ROAD

PARK ROAD

AJO HIGHWAY

OLD TUCSON

75

70

65

VALENCIA ROAD

POSTVALE ROAD

VAHALLA ROAD

AJO HIGHWAY

LOS REALES ROAD

Exhibit C-3D

2020 AIRCRAFT NOISE EXPOSURE WITH LAND USE

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Ultimate Property Line
- DNL Contour, Significant Effect
- Single Family Residential
- Multi-Family Residential
- Mobile Home
- Open Space

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998, Updated by Coffman Associates, March 1999.

NORTH

0 3000

SCALE IN FEET

TUCSON AIRPORT AUTHORITY

98SP00-C-2E-05/26/99

BOPP ROAD
SAN JOAQUIN ROAD
AIRLINE ROAD
SNYDER HILL ROAD
CONTINENTAL ROAD
BRANIFF ROAD
NEBRASKA ROAD
MARSTELLAR ROAD
SANDARIO ROAD
PARK ROAD
AJO HIGHWAY
OLD TUCSON
Rte 86
75
70
65
Runway 11L-29R
Runway 11R-29L
Taxiway Bike
VALENCIA ROAD
POSTVALE ROAD
VAHALLA ROAD
AJO HIGHWAY
Rte 86
LOS REALES ROAD

Exhibit C-2E
1999 AIRCRAFT NOISE EXPOSURE

LEGEND

- Detailed Land Use Study Area
- Airport Property
- DNL Contour, Significant Effect

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998.
Coffman Associates Analysis.

NORTH

0 3000

SCALE IN FEET

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AIRPORT AUTHORITY

6L, by about 300 feet. An extremely small portion of the 70 DNL contour gets off airport property at this location as well. All the 75 DNL contour, which separates into several parts representing activity at the runway ends, remains on airport property.

TABLE C-2C
Comparative Areas of Noise Exposure
Ryan Airfield

	Area in Square Miles		
DNL Contour	1999	2004	2020
65	0.59	0.63	0.83
70	0.31	0.34	0.46
75	0.12	0.14	0.18

2004 Noise Exposure Contours

The 2004 noise contours represent the estimated noise conditions based on the forecasts of future operations. **Exhibit C-2F** presents the plotted results of the 2004 conditions using input data described in the preceding pages.

The 2004 contours maintain the same general shape as their 1999 counterparts. The increase in size reflects the forecast increase in annual operations. **Table C-2C** shows the surface areas for this contour set.

The proposed property boundaries would contain Much like its counterpart in the 1999 scenario, the 65 DNL contour gets off airport property about 200 feet on the north, and about 400 feet on the northwest. The 70 DNL contour, except northwest bulge of approximately 100 feet, lies on airport property. As in 1999, the 75 DNL contour, which separates into several parts, remains on airport property, staying very close to the runways.

2020 Noise Exposure Contours

The 2020 noise contours represent the estimated noise conditions based on the forecast future operations with a change in airport configuration. The master plan has recommended an extension on the west end of Runway 6R-24L, bringing its total length to 8,300 feet. In addition, the recommendation of extending Runway 15/33 800 feet to the north has been incorporated. As shown on **Exhibit C-2G**, although the long range contours retain the same general shape as the near-term, the forecast increase in operations make the contour set bigger, and they shift to the west, following the runway extensions. **Table C-2C** shows the surface areas for this contour set.

The 65 DNL contour extends 9,300 feet from west to east. It escapes airport property on the north by about 300 feet and on the west by about 600 feet. However, it remains on airport property on the east side since the proposed runway extension is scheduled for the southwest end of Runway 6R/24L. The extension of Runway 15/33 to the north causes the 65 DNL contour to extend slightly beyond the airport property. The 70 DNL contour remains on the airport except for that small bulge on the west side. The increase in the forecast operations levels results in a one part 75 DNL contour which circles the runway system.

SUMMARY

The information presented in this chapter defines the patterns of noise exposure for current and forecast future aircraft operations in the vicinity of Ryan Airfield. The current contours represent an average day's activity for 1999. The five-year and twenty-year noise exposure levels around the airport increases with the forecast increase in operations. In addition, the extension of noise contours is affected by infrastructure changes proposed at the airfield within the long term horizon.

DNL contour lines drawn on a map do not represent absolute boundaries of acceptability or unacceptability in personal response to noise. They do not represent the actual noise conditions present on any specific day. The contours illustrate the conditions of an average day derived from annual average information.

98SP00-C-2F-05/26/99

BOPP ROAD
SAN JOAQUIN ROAD
AIRLINE ROAD
SNYDER HILL ROAD
CONTINENTAL ROAD
BRANIFF ROAD
NEBRASKA ROAD
MARSTELLAR ROAD
SANDARIO ROAD
PARK ROAD
AJO HIGHWAY
OLD TUCSON
Route 86
75
70
65
VALENCIA ROAD
POSTVALE ROAD
VAHALLA ROAD
AJO HIGHWAY
LOS REALES ROAD

Exhibit C-2F
2004 AIRCRAFT NOISE EXPOSURE

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Ultimate Property Line
- DNL Contour, Significant Effect

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998.
Coffman Associates Analysis.

NORTH
0 3000
SCALE IN FEET

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985P00-C-2G-05/26/99

BOPP ROAD
SAN JOAQUIN ROAD
AIRLINE ROAD
SNYDER HILL ROAD
MARSTELLAR ROAD
SANDARIO ROAD
CONTINENTAL ROAD
BRANIFF ROAD
NEBRASKA ROAD
PARK ROAD
AJO HIGHWAY
OLD TUCSON
75
70
65
VALENCIA ROAD
POSTVALE ROAD
VAHALLA ROAD
AJO HIGHWAY
LOS REALES ROAD

Exhibit C-2G
2020 AIRCRAFT NOISE EXPOSURE

LEGEND

- Detailed Land Use Study Area
- Airport Property
- Ultimate Property Line
- DNL Contour, Significant Effect

Source: Digital Map from Pima County, Land Information System for ArcView 3.0, October 1, 1998.
Coffman Associates Analysis.

NORTH

0 3000
SCALE IN FEET

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Appendix C-3
NOISE IMPACTS

The impacts of aircraft noise on existing and future land use and population are examined in this chapter. The effects of noise on people include hearing loss, other ill health effects, and annoyance. While harm to physical health is generally not a problem in neighborhoods near airports, annoyance is a common problem. Annoyance is caused by sleep disruption, interruption of conversations, interference with radio and television listening, and disturbance of quiet relaxation.

Individual responses to noise are highly variable, making it very difficult to predict how any person is likely to react to environmental noise. The average response among a large group of people, however, is much less variable and has been found to correlate well with cumulative noise dosage metrics such as Leq and DNL. The development of aircraft noise impact analysis techniques has been based on this relationship between average community response and cumulative noise exposure.

This chapter deals with the following topics:

- Land Use Compatibility
- Current Noise Impacts
- Future Noise Impacts

LAND USE COMPATIBILITY

The degree of annoyance which people suffer from aircraft noise varies depending on their activities at any given time. People rarely are as disturbed by aircraft noise when they are shopping, working, or driving as when they are at home. Transient hotel and motel residents seldom express as much concern with aircraft noise as do permanent residents of an area.

The concept of "land use compatibility" has arisen from this systematic variation in human tolerance to aircraft noise. Studies by governmental agencies and private researchers have defined the compatibility of different land uses with varying noise levels. The FAA has established guidelines for defining land use compatibility for use in Federal Aviation Regulation (F.A.R.) Part 150 studies.

F.A.R. PART 150 GUIDELINES

The FAA adopted land use compatibility guidelines when it promulgated F.A.R. Part 150 in the early 1980s. (The Interim Rule was adopted on January 19, 1981. The final rule was adopted on December 13, 1984, published in the Federal Register on December 18, and became effective on January 18, 1985.) These were based on earlier studies and guidelines developed by federal agencies (FICUN 1980). These land use compatibility guidelines are only advisory; they are not regulations. Part 150 explicitly states that determinations of noise compatibility and regulation of land use are purely local responsibilities. (See Section A150.101(a) and (d) and explanatory note in Table 1 of F.A.R. Part 150). **Exhibit C-3A** lists the F.A.R. Part 150 land use compatibility guidelines.

FAA uses the Part 150 guidelines as the basis for defining areas within which noise compatibility projects may be eligible for federal funding through the noise set aside of the Airport Improvement Program (AIP). In general, noise compatibility projects must be within the 65 DNL contour to be eligible for federal funding. According to the Airport Improvement Program (AIP) Handbook, "Noise compatibility projects usually must be located in areas where noise measured in day-night average sound level (DNL) is 65 decibels (dB) or greater" (Order 5100.38A, Chapter 7, paragraph 710.b). Funding is permitted outside the 65 DNL contour only where the airport sponsor has determined that non-compatible land uses exist at lower noise levels and the FAA has explicitly concurred with that determination.

The FAA guidelines in **Exhibit C-3A** show that residential development is incompatible with noise above 65 DNL. Schools and other public use facilities are generally incompatible with noise between DNL 65 and DNL 75, but the guidelines note that, where local communities determine that these uses are permissible, sound insulation measures should be used. Mobile homes tend to be somewhat more sensitive to noise than other residential structures because they tend to have lower outdoor-to-indoor noise attenuation capabilities. In addition, it is impractical to retrofit mobile homes with soundproofing.

For this Part 150 Noise Compatibility Plan, the FAA's land use compatibility guidelines will be used as the basis for making determinations about land use compatibility in the airport area. These guidelines recognize that significant noise impacts begin at DNL levels above 65 decibels. They are in general agreement with State and local noise compatibility policies.

98MP13-C3A-5/17/99

LAND USE	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
PUBLIC USE						
Schools	Y	N[1]	N[1]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	Y[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
COMMERCIAL USE						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y[5]	Y[5]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

See other side for notes and key to table.

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Exhibit C-3A
LAND USE COMPATIBILITY GUIDELINES

KEY

Y (Yes)	Land Use and related structures compatible without restrictions.
N (No)	Land Use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, 35	Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

NOTES

1 Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR)of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2 Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

3 Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

4 Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

5 Land use compatible provided special sound reinforcement systems are installed.

6 Residential buildings require a NLR of 25.

7 Residential buildings require a NLR of 30.

8 Residential buildings not permitted.

Source: ***F.A.R. Part 150,*** *Appendix A, Table 1.*

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Exhibit C-3A (Continued)
LAND USE COMPATIBILITY GUIDELINES

The FAA guidelines show in **Exhibit C-3A** that mobile homes and outdoor music shells and amphitheaters are incompatible with noise above 65 DNL. Schools and residential uses other than mobile homes are generally incompatible with noise between 65 DNL and 75 DNL, but the guidelines note that, where local communities determine that these uses are permissible, sound attenuation measures should be used.

Nature exhibits and zoos are considered incompatible at levels exceeding 70 DNL. Several other uses including hospitals, nursing homes, churches, auditoriums, concert halls, livestock breeding, amusements, resorts, and caps are considered incompatible at levels above 75 DNL.

Many uses are considered compatible in areas subject to noise between 65 DNL and 75 DNL if prescribed levels of sound attenuation can be achieved through methods of sound proofing. These include hospitals, nursing homes, churches, auditoriums, and concert halls.

NOISE IMPACTS

Noise impacts refer to the effect significant levels of noise have upon an area. In assessing community noise impacts, the number of people impacted and the level of noise impacting them must be considered. While lower noise levels cover a larger area and usually affect more people, they are less annoying than higher noise levels.

Noise-sensitive land uses shown on the exhibit are based on the FAA's land use compatibility guidelines presented in **Exhibit C-3A**.

Land use is correlated to the impact noise will have on a given population. In addition, land use can also offer an indication to the number of individuals who can be expected to be affected by certain levels of noise.

The affected population is calculated by counting the number of dwelling units within a given contour range and multiplying that number by the average household size (2.49) for the County of Pima according to the 1996 Census Population Estimates.

Current Impacts -1999

Exhibit C-3B, 1999 Aviation Noise with Land Use, shows the location of noise-sensitive land uses and the 1999 noise contours at Ryan Airfield.

The 65 DNL contour remains contained within the airport property with the exception of two locations: north of the end of Runway 6L near Airline Road, and 800 feet northwest of Runway 6L/24R. The encroachment of this contour beyond the airport property is primarily due to the limited distance between the runway and the property boundaries at these two locations. The 65 DNL contour does not affect any dwellings or noise sensitive land uses, subsequently, no people are affected by significant aviation related noise.

The 70 DNL contour crosses the airport property boundary approximately 500 feet northeast of Runway 6L/24R. There are no dwellings or noise sensitive land uses affected by this contour. The remainder of the 70 DNL and the entire 75 DNL contour remain completely within airport property.

Future Impacts - 2004

Exhibit C-3C shows the noise projected at Ryan Airfield for the year 2004. Existing noise-sensitive land uses are shown on the exhibit as are areas designated in the General Plan for future residential development. In addition, ultimate airport property boundaries, suggested in the *Ryan Airfield Airport Master Plan*, are depicted to show the potential future airport property.

The noise contours for the year 2004 are similar in shape to the 1999 contours but contain more area. This is due to the projected increase in aircraft operations and changes in aircraft types during this period.

At its greatest extent, the 65 DNL contour extends about 1,500 feet beyond the east end of the Runway 6R/24L. It also extends about 1,500 feet southeast of the opposite end of the runway. This contour extends beyond the airport property boundary at two locations. Near the northeast end of Runway 6L/24R, the 65 DNL contour extends approximately 200 feet north of the property line. At the northwest end of the property, the 65 DNL contour reaches 500 feet into an area of open space beyond the airport property northwest of the southwest end of Runway 6L/24R. There are no dwelling units or noise sensitive land uses inside this contour.

The shape of the contour reflects the predominance of departures to the east and arrivals from the west. The lobe shaped contour on the east side is characteristic of a noise contour dominated by aircraft departures. The narrow blunt contour to the west reflects the dominance of aircraft arrivals from that direction.

The 70 DNL contour extends beyond the property for approximately 100 feet near the southwest end of Runway 24R. The 75 DNL contour is completely contained within airport property. Neither the 70 of 75 DNL contours encroach upon dwellings or noise sensitive land uses.

The incorporation of the ultimate airport boundary proposal outlined in the *Ryan Airfield Master Plan* would ensure the containment of the projected 2004 noise contours. In this scenario, all the significant aviation noise contours would remain on airport property.

Future Impacts - 2020

Exhibit C-3D shows the noise projected at Ryan Airfield for the year 2020. It also shows existing and potential future areas of noise-sensitive land uses and existing (1999) and potential ultimate airport property boundaries.

The 2020 noise contours encompass a significantly larger area than that of

those in 1999 and 2004. This increase is primarily due to the extension of Runway 6R/24L 2,800 feet to the southwest to an ultimate length of 8,300 feet and the extension of Runway 15/33 800 feet north to an ultimate length of 4,800 feet. These extensions will allow for increased traffic and a greater flexibility in the airport fleet mix which will account for greater noise potential.

The 65 DNL contour still extends north of the property line north of Runway 6L/24R. The contour at this location has increased and extends approximately 300 feet beyond the property boundary. The addition to Runway 15/33 causes the 65 DNL contour to extend slightly past the property line immediately north of the runway end.

The 65 DNL contour also deviates from the airport property near the southwest end of Runway 24R as in 1999 and 2004. The 65 DNL contour extends approximately 600 feet beyond the airport property. The 65 DNL contour does not encroach upon any dwellings or noise sensitive land uses.

The 70 DNL contour leaves the property at this same location for 200 feet. The 70 DNL contour also does not encroach upon any dwelling units or noise sensitive land uses.

The 75 DNL contour, although increasing in size, still remains wholly within the confines of the airport property.

The *Airport Master Plan* has recommended the acquisition of additional property at several locations to incorporate runway protection zones (RPZ's) associated with runway extensions. In addition, additional land is recommended for acquisition in order to contain sound to the 65 DNL. This action would ensure that no future noise sensitive land uses would be affected by aviation related noise through the span of this study.

NOISE EXPOSURE AREA

Current Noise Exposure Area - 1999

The acreage within the 1999 noise exposure contours is depicted on **Table C-3A**. As seen on **Table C-3A**, approximately 173 acres acres of land are exposed to the 65 DNL noise level. This is an increase of 32 acres from the 1989 65 DNL area. The 70 and 75 DNL levels have increase in area as well. They encompass areas of approximately 125 acres (70 DNL) and 76 acres (75 DNL). This is an increase over 1989 areas of 61 acres and 38 acres respectfully. Although all contours increase in size, only the 65 and 70 DNL contours progress outside the airport property in 1999. The exposure of non-airport property to noise above 65 DNL was not present during the 1989 NCP study.

Future Noise Exposure Area - 2004

The 2004 noise exposure surface area is also expressed in **Table C-3A**. All contours measured in this study have increase in area when compared the 1989 NCP study. The projected 2004 65 DNL contour is expected to cover over

185 acres. This is a slightly larger than the projected 204 acres expected in 2009. This trend is also seen when comparing 70 and 75 DNL contours from past and present studies. Neither the 70 nor 75 DNL contours in affect noise sensitive land uses in 2004, although the 70 DNL contour does breach the airport property. The adherence to proposed property acquisition, shown on **Exhibit C-3C**, would eliminate the migration of noise contours beyond airport property in 2004.

TABLE C-3A
Summary Of Noise Exposure And Impacts

Year, DNL Contour	Total Area Inside Contours (acres)	Area Inside Airport Property (acres)	Area Outside Airport Property (acres)	
			Without Recommended Land Acquisition	With Recommended Land Acquisition
1999 - EXISTING CONDITIONS				
65-70	173.48	169.73	3.75	0.00
70-75	125.07	125.02	0.05	0.00
75+	76.00	76.00	0.00	0.00
Total	374.55	370.75	3.8	0.00
2004 - FORECAST				
65-70	185.58	178.51	7.07	0.00
70-75	130.78	130.66	0.12	0.00
75+	86.88	86.88	0.00	0.00
Total	403.23	406.05	7.19	0.00
2020 - FORECAST				
65-70	235.57	220.55	15.02	0.00
70-75	181.70	181.01	0.69	0.00
75+	113.74	113.74	0.00	0.00
Total	531.01	535.25	15.71	0.00

Source: Coffman Associates analysis.

Future Noise Exposure Area - 2020

The 65 DNL contour increases nearly 75 percent by the year 2020 in relation to its 1999 area. This trend is reflected in both the 70 and 75 DNL contours (68% and 66% respectfully). This increase in noise contours area is related to the completion of airport development projects and increase aircraft activity. As in 2004, the proposed property acquisition shown on **Exhibit C-3D** would incorporated all significant aviation noise contours in the year 2020.

NOISE COMPATIBILITY REVIEW

The previous Noise Compatibility Plan, completed in July 1990, presented a number of alternatives referring to Noise Abatement, Land Use Management and Implementation measures. These alternatives are addressed and evaluated in Appendix C-1 pages C-1-24 to C-1-26. Due to changes in projected aircraft operations and infrastructure additions at Ryan Airfield, two additional recommendations are warranted.

The construction of Runway 6L/24R since the previous study period has resulted in the migration of the 65 DNL contour north of the existing airport property line. Furthermore, this addition has also resulted in the 65 and 70 DNL contours breaching the airport property boundary west of this runway. During the scope of this study, changes in aircraft operations in addition to extensions of Runways 6R/24L and 15/33 result in a further expanse of the 65 and 70 DNL contours beyond the current airport property boundary. This further supports the property acquisition recommendation presented in the concurrent Airport Master Plan as a means of preventing incompatible land uses from occupying this area. Property recommended for acquisition is depicted on the Airport Layout Plan (Sheet 2 in Chapter Five of this Master Plan).

The Noise Compatibility Plan suggested the Airport Authority encourage Pima County to amend the Southwest Area Plan in accordance with recommendations presented in the previous Master Plan and Part 150 Noise Compatibility Plan or adopt the Noise Compatibility Plan as a general planning guideline. This would allow the County to refine its planning and development objectives regarding areas potentially affected by aviation noise.

Since the completion of the previous Master Plan and the Noise Compatibility Plan, the Southwest Area Plan was subsumed by the Pima County Comprehensive Plan. The Comprehensive Plan does not specifically address issues pertaining to noise compatibility issues. As a result of the projected expanse of significant aviation related noise contours, it is suggested that the Airport Authority encourage Pima County to amend the Comprehensive Plan to reflect recommendations presented in the Master Plan and Noise Compatibility Plan or adopt the Noise Compatibility Plan as a general planning guideline.

SUMMARY

This chapter has analyzed the impacts of existing and projected future aircraft noise on noise-sensitive land use and population in the vicinity of Ryan Airfield. The relatively remote location, in addition to the adoption of recommended property acquisition, no land use or population is expected to be impacted by airport related noise around Ryan Airfield.